Lubrication ENGINEERING

JOURNAL OF THE AMERICAN SOCIETY OF LUBRICATION ENGINEERS

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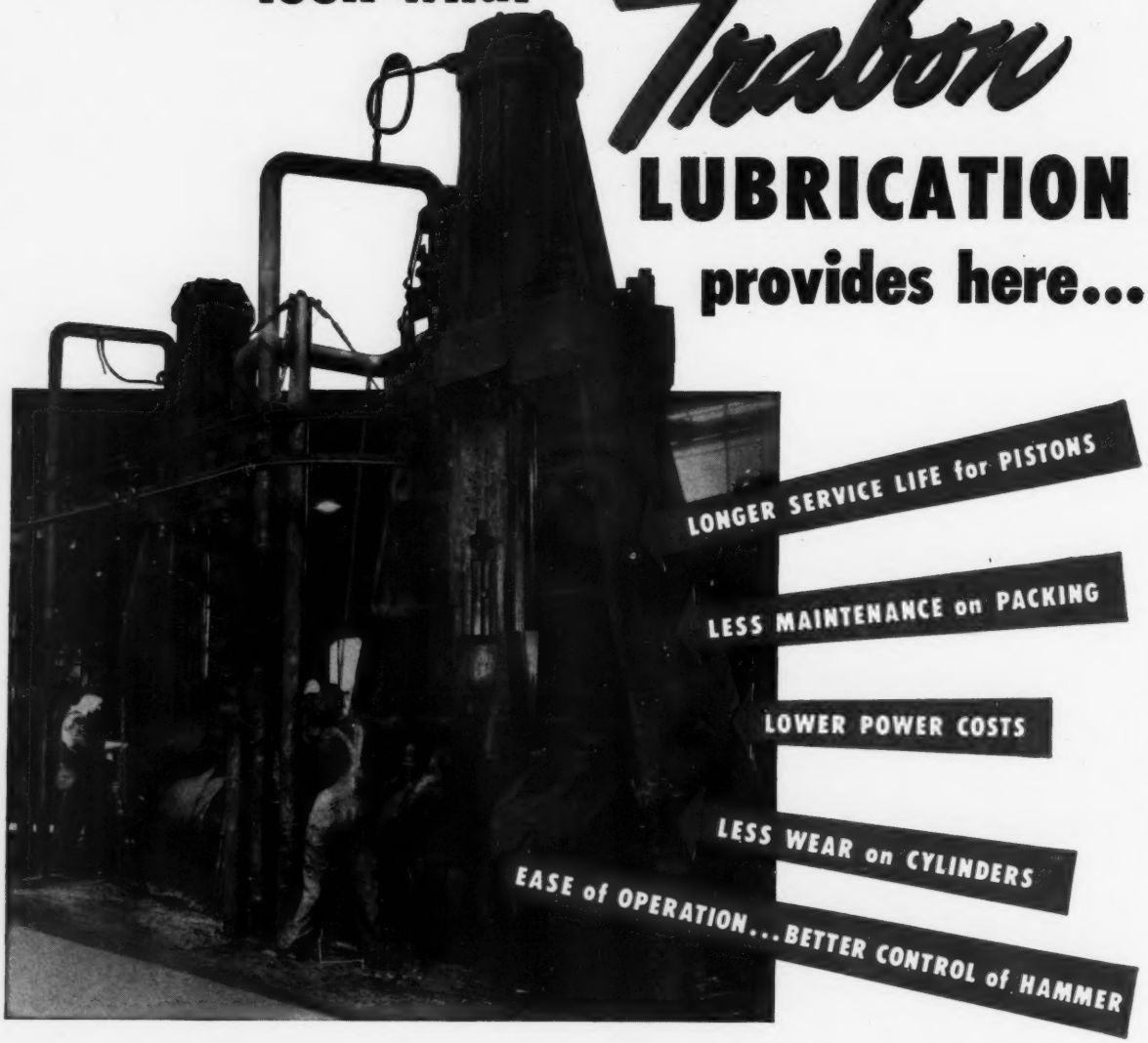
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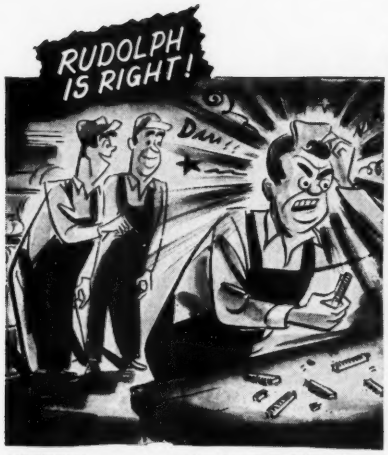

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Lubrication ENGINEERING

VOL. 8 FEBRUARY, 1952 No. 1

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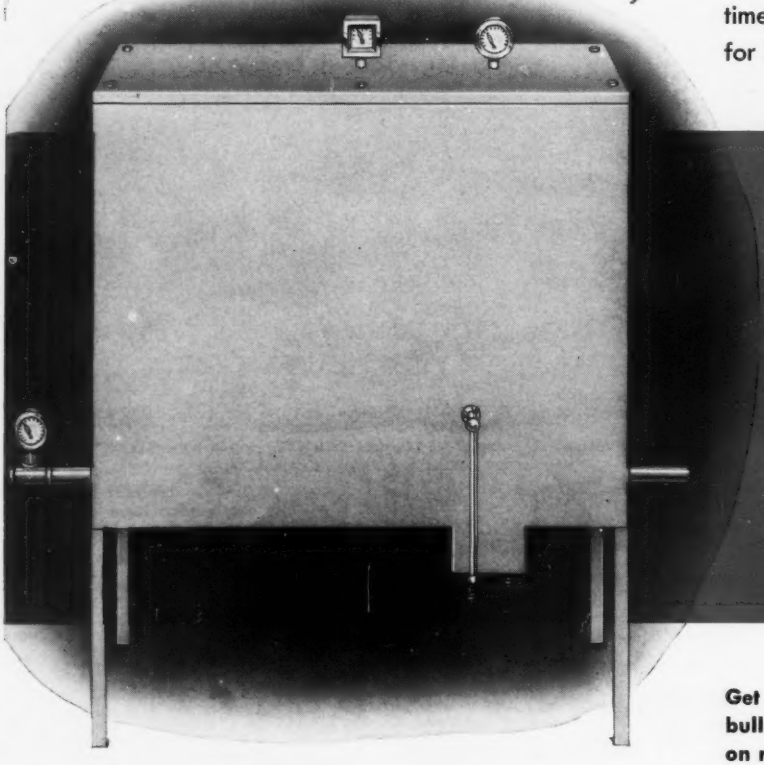
Unit is easy to install, simple to operate. Eliminates unnecessary downtime and costly repairs. Quickly pays for itself in oil savings alone.



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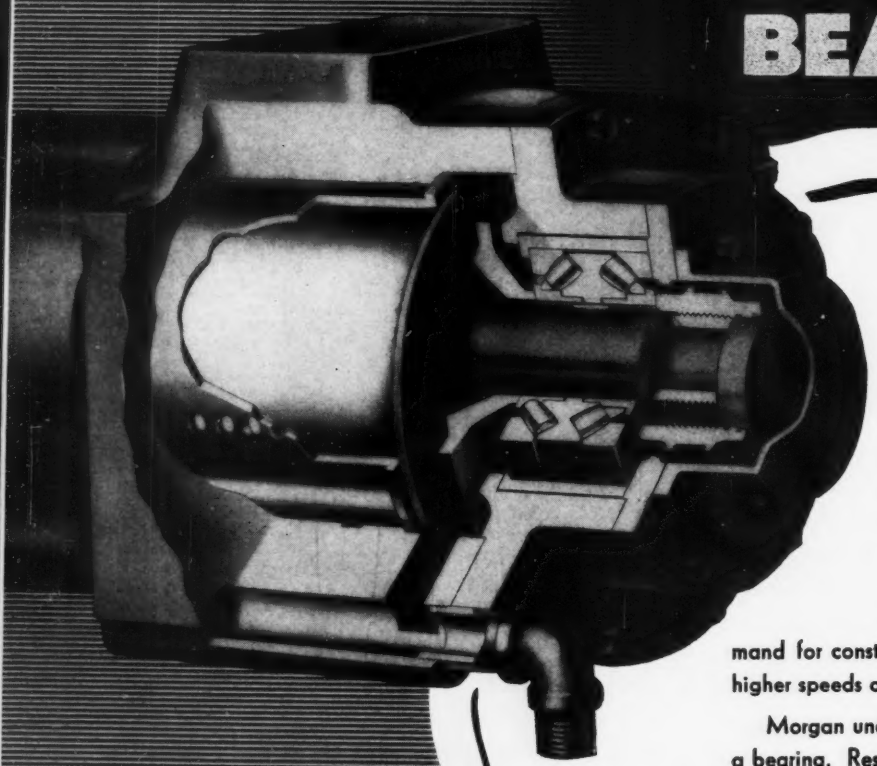

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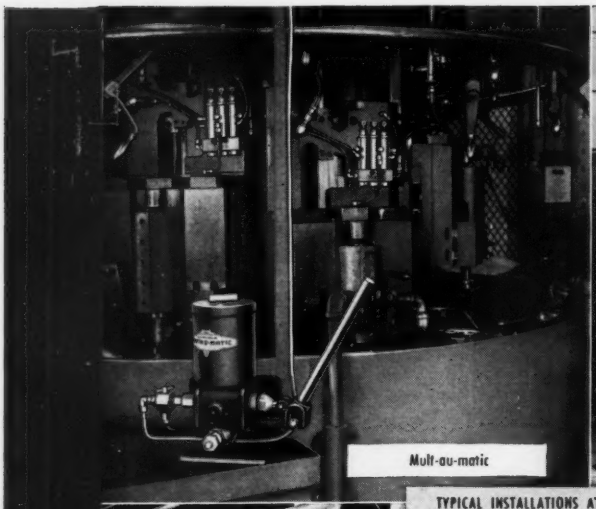
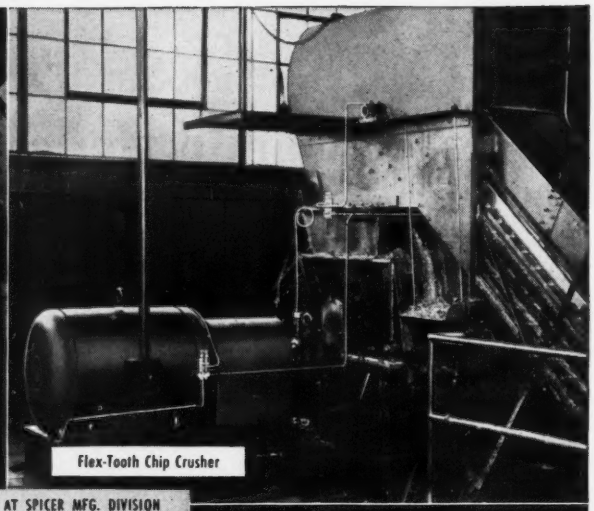
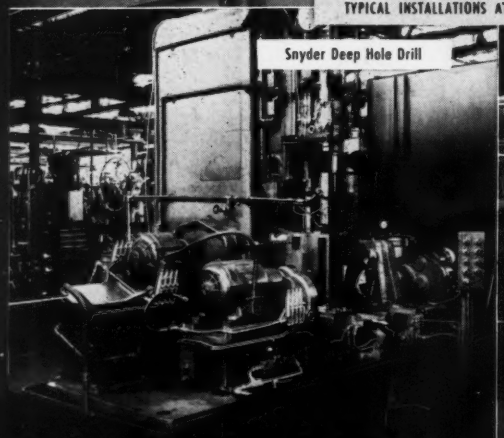


Mult-au-matic

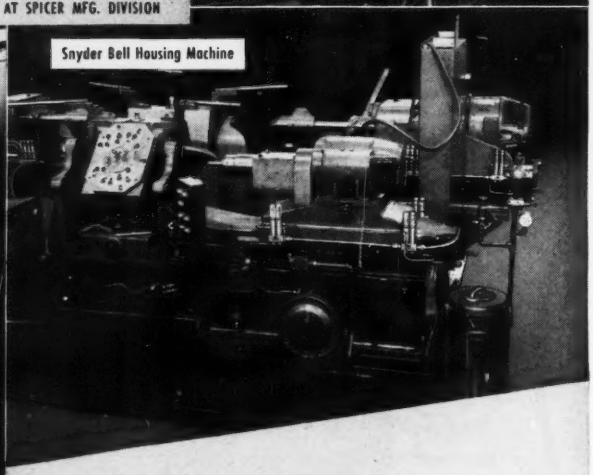


Flex-Tooth Chip Crusher

TYPICAL INSTALLATIONS AT SPICER MFG. DIVISION



Snyder Deep Hole Drill



Snyder Bell Housing Machine

"Replacing Hand Lubrication with LINCOLN Centralized Lubrication Systems Saves Us Approximately $100,000 Annually"

R. C. Lohbauer
Production Engineering Staff
Spicer Mfg., Division of Dana Corp.
Toledo, Ohio

'There is more to lubrication than Webster's definition, 'to make slippery'. We define lubrication as 'applying lubricants to bearings in such a manner as to maintain a constant film of oil between moving surfaces'.

"Four years ago, a study of our lubrication practices and costs led us to a program of *standardizing* our lubrication methods by installing Lincoln Centralized Lubrication Systems on 86 vital machines. Here are some of the amazing figures in cost reduction resulting from our program:

Bullard Mult-au-matic Lathes

Maintenance cost reduced 60% or $72,000 annually
Production increased 20%
Produces better quality of work
Reduction in amount of scrap
Direct labor saving of $25,000 annually.

Atmospheric Controlled Gas Carburize Furnace

Direct maintenance labor savings, $1,200 per year
Savings in bearing material, $600 per year
Eliminated one hour per day lubricating allowances, $580 per year
Output increased 13% due to decrease in down-time.

Chip Crusher

Direct labor saving of $1,280 annually
Saving in replacement parts, $500 annually
Elimination of full time maintenance man, $4,667.52 annually.

"These are typical of savings effected throughout the plant. Lubrication boils down to maintaining a constant film of oil between moving surfaces by applying the *right lubricant* at the *right time* and in the *right quantity*, by the proper method."

R. C. Lohbauer, Production Engineering Staff
Spicer Mfg., Division of Dana Corp.
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DOW CORNING

Silicone Notes

ON LUBRICATION

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FILE SILICONE LUBRICANTS

Make sure you have basic data sheets BG-2, 5502, 7101. If misplaced write Department BW-14

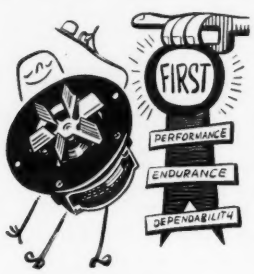
DOW CORNING CORPORATION
Midland, Michigan

DOW CORNING 200 FLUID

Dow Corning 200 Fluid has been tested at various temperatures in contact with oxygen under a pressure of 2000 psi. Presence of silicon dioxide was taken as evidence of oxidation. After 1 hour at 300° F. and after one-half hour at 390° F. there was no evidence of oxidation.

In actual practice, that kind of oxidation resistance is illustrated by the experience of the Breese Burners, Inc., of Santa Fe, New Mexico who manufacture the Drafbooster, a forced-air fan for oil-fired furnaces.

Back in 1940, Breese engineers installed a Drafbooster in a heater designed for use in their own offices. All went well the first season, but by the following season it was noted that the petroleum oil lubricating the fan motor's porous bronze bearings had thickened. The fan refused to run at normal speed; insufficient air was provided for complete combustion. By mid-winter, the Drafbooster had to be replaced.



The same thing happened with the next Drafbooster, and the next, and the next. Then, in November of 1945, they installed a unit lubricated with Dow Corning 200 Fluid. This Drafbooster has been in operation 6 years without replacement, relubrication or cleaning.

Breese engineers recently inspected their office unit and reported only negligible bearing wear. The silicone fluid has not thickened and is still crystal-clear. Dow Corning 200 Fluid satisfies their requirements so completely, they say, that if this silicone fluid suddenly became unavailable, they'd stop making Drafboosters.

DOW CORNING 550 SILICONE OIL

Dow Corning 550 is notable even among silicone fluids for its exceptional heat stability. Stability and oxidation resistance are demonstrated by the fact that it does not gel or decompose to form gums even after heating at 482° F. for 1000 hours in contact with air.

To Flash-O-Graph Corporation, of Long Island City, New York, that kind of oxidation resistance means an annual saving of thousands of dollars in maintenance and repair costs.

The Flash-O-Graph is an animated advertising sign for store windows and counters. The advertiser's message is punched in a black ribbon belt which is driven across the front of a fluorescent lamp by a phonograph-type motor. It is estimated that the belt revolves 31 million times a year.

For appearance's sake, the sign is almost totally enclosed. As a result, considerable heat develops and failure of the motor's sintered-bronze bearings is common. Once, in fact, an entire order of 1000 signs was replaced less than a week after shipment because of bearing failures.

Then, 16 months ago, Flash-O-Graph ran comparative tests between six signs lubricated with the highest grade petroleum oils and six with Dow Corning 550 silicone oil. The best of the petroleum lubricated group lasted only 20 days without relubrication. All six of the silicone lubricated group are still running . . . without relubrication.

About a year ago Flash-O-Graph standardized on Dow Corning 550 silicone oil for the bearings of sign motors. They estimate their service problem has been reduced 99%. Of thousands of silicone lubricated units since put into the field, not one has been returned because of bearing failure.

DOW CORNING CORPORATION • MIDLAND, MICHIGAN

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CANADA: Fiberglas Canada Ltd., 1200 Bay Street, Toronto, Ontario ENGLAND: Midland Silicones Ltd., 49 Park Lane, London, W. 1

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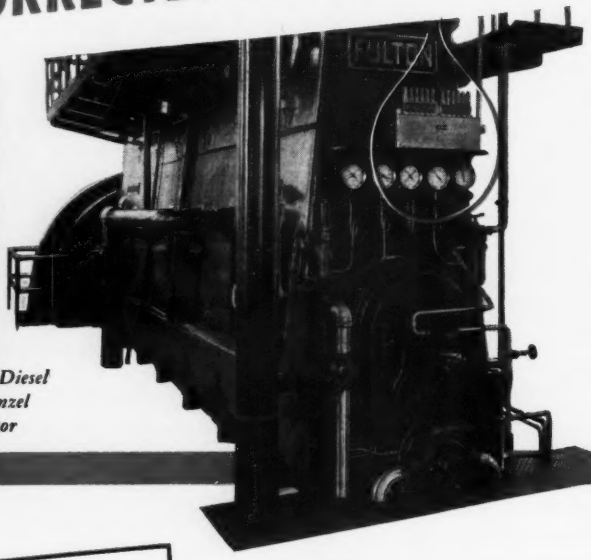

A Fulton type KT Diesel equipped with Manzel Model 94 Lubricator

Remember

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AT THE CLEVELAND ASLE SHOW

MANZEL Lubricators permit individual adjustment of the oil pumped to *each* wearing point. By supplying the *exact* amount needed at each point and *no more,* Manzels reduce oil consumption as much as 90%. Once set they require no attention except to maintain the oil supply in the reservoir.

Manzel Force Feed Lubricators are furnished as standard equipment on many of the leading makes of diesel, gas, and steam engines, compressors, pumps, and other heavy machinery. Or they can be installed on your present equipment. They may be synchronized by ratchet or direct lever drive, or operated by a separate electric motor.

We will gladly have a Manzel lubrication engineer submit recommendations without obligation. Just write . . .

Manzel

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Lube Lines

Summer Course at Georgia Tech

Georgia Institute of Technology announces a two-week summer course in lubrication engineering to be held in Atlanta, Georgia, June 16 to 28, 1952. This program, which has the sponsorship of the ASLE, is designed primarily for the engineer responsible for lubrication scheduling and maintenance in an industrial plant. Since all lubrication engineering education is at present available only at the graduate level, this course will be designed to include the man with engineering experience who has not necessarily attained an engineering degree. It is also intended for engineering students who are interested in taking advantage of the growing demand by industry for men trained in this field.

The course will cover all the basic and special information needed by a lubrication engineer in meeting his responsibilities in an industrial plant.

Course Syllabus

Lubrication Engineering: (Scope—Importance).
Hydrodynamic Theory: (Slider Bearings—Journal Bearings—Partial Bearings—Imperfect Lubrication).
Practical Bearing Design: (Proportions—Clearances—Operating Factors—Grooving—Oil Supply—Cooling).
Bearing Materials: (Metallic—Non-Metallic—Surface Treatments).
Lubricants: (Fluid—Solid—Synthetic).
Lubricant Technology: (Additives—Rust Preventives—Testing—Filtering—Reclaiming).
Lubricant Dispensing: (Gravity Feed—Wick Feed—Forced Feed—Splash Feed—Grease Systems—Seals, Gaskets and Packing).
Recent Lubrication Developments: (Lubricants—Materials—Theory—Design).
Rolling Bearings: (Bearing Technology — Bearing Materials—Bearing Lubrication—Bearing Maintenance).
Gear Lubrication: (Lubricants—Practice—Special Problems).
Textile Machinery Lubrication: (Lubricants—Practice—Special Problems).
Cutting Fluids Technology: (Cutting Fluids—Coolant Function—Lubricant Function).
Plant Organization: (Lubrication Section—Lubrication Schedules—Bearing Maintenance—Personnel Training).

Discussion Forums on lubrication topics of most interest to those attending will also be organized where possible. Throughout the course, emphasis will be placed. on recent developments and their practical applications. Lectures and discussions will be supplemented by laboratory demonstrations.

The course will be under the direction of Professor Joseph P. Vidosic, School of Mechanical Engineering, Georgia Institute of Technology. He will be assisted by members of the Institute's staff, and several of the lectures will be given by representatives from industry who are noted authorities in their respective fields, and who are well known to the readers of LUBRICATION ENGINEERING.

Since enrollment in the summer course will be definitely limited, early registration is advisable. Letters of application should include the applicant's educational background and professional experience. The tuition for the two-week course will be $100.

The campus is located near the center of Atlanta. Students are asked to make their own reservations at one of the nearby hotels. Hotel rates range from $5.00 to $5.50 per day (average) for single rooms, and $7.50 per day (average) for double rooms. For the convenience of students we are listing three of the well known Atlanta hotels near the campus.

The Atlanta Biltmore
The Georgian Terrace
The Cox Carlton

Summer guests are invited to use the Institute's libraries and recreational facilities.

All requests for further information and letters of application should be sent to Mr. C. H. Taylor, Director, Short Courses and Conferences, Georgia Institute of Technology, Atlanta, Georgia.

The Leonards

Patricia Leonard, Managing Editor of this publication, Convention and Exhibit Manager, ASLE and W. F. Leonard, Secretary and Assistant Treasurer of ASLE, announce their resignations from their responsibilities in the Society effective March 1st, 1952.

It is with deep regret that we relinquish our personal contacts with our many friends in the Society.

We desire to express our sincere appreciation for the friendly cooperation we have received in our past endeavors.

NUMBER 8

STEAM TURBINE LUBRICATION*

By A. S. Morrow

Staff Engineer
Lubricants Department
Shell Oil Company

Mr. Morrow graduated from Lehigh University in 1940 with a B.S. degree in Chemical Engineering. He then joined Socony-Vacuum Oil Company as refinery engineer working in the laboratory, and on topping, catalytic cracking and gas recovery plants.
In 1942 he was commissioned in the Naval Reserve as Petroleum Engineer. His entire war service consisted of petroleum work such as trouble-shooting fuels and lubricants.
Mr. Morrow joined Shell Oil Company in 1946 and is now Staff Engineer, Lubricants Department, specializing on turbine and hydraulic system lubrication.

Since double-inhibited turbine oil has now become generally accepted by the turbine builder and operator, this type of lubricant will be considered exclusively in the following discussion with only a brief mention of the straight mineral type.

Lubricating Oil Systems

The turbine manufacturer today is very cognizant of the necessity for providing a well-designed lubricating oil system which will afford the maximum efficiency for lubrication, cooling, and removal of contaminants from the bearings, gears, and hydraulic mechanisms. In this regard the oil sump plays the major role in maintaining the oil in a satisfactory condition. The sump is usually large enough to provide a "rest" period for the oil so that water and solid contaminants can settle and the air and vapors be released. A well-designed tank has a V or hopper bottom for collecting precipitates, baffles to decrease surging and strainer baskets at the oil return line. A positive vent on the sump for removal of vapors, as well as proper connections for removal of oil to be purified, is also essential.

Manufacturers now offer sump tanks, incorporating the above characteristics. The tanks are of welded steel construction, free of horizontal ribbing that in the past acted as pockets wherein solid contaminants could collect. In the smaller turbines the sumps normally are adjacent to the unit but not an integral part of it, while the sump for the larger units may be located at a considerable distance.

Oil cooling in ring-oiled units is usually accomplished by circulating water through a coil or drilled passages in the oil reservoir. The larger units have separate coolers of the tube or fin type. The main and auxiliary lube oil pumps should be so piped that any emergency could be coped with; i.e., proper alarms and relays installed so that there is no possibility of an oil supply failure.

Low carbon steel, cast iron, copper and copper alloys are generally used in lube systems because of their low cost, ease of fabrication and strength, even though they are fairly active catalysts in promoting oil deterioration. However, their effect on inhibited oils in no way compares with that found for noninhibited oils. The effect of catalysis also can be considerably reduced by increasing the ratio of the oil volume to the contacted surfaces. The less catalytic metals, such as stainless steel and aluminum, are not used because of either the cost factor, or inherent structural weakness. Present-day practice requires that low-carbon steel, since it is the least active of the metals, be used for lubricating systems of turbines.

The conditioning of the lubricant in any circulating system is added insurance for providing extended trouble-free oil life. (See Fig. 1.) Although some manufacturers install knife-edge filters or fine mesh wire strainers in the oil lines at time of manufacture, equipment for complete removal of water, solid contaminants, and oil deterioration products is the responsibility of the operator. This auxiliary purification can be maintained on either a continuous by-pass or batching basis. The former is much preferred since the removal of 5-10% per hour of the oil from the sump will maintain the contaminants at a low concentration. Types of purification equipment most applicable to inhibited oils are centrifuges, blotter presses, and filters of the waste-packed, cotton, or paper cartridge type, or cloth bags. Compact units containing a settling section, cloth bag filter chamber, followed by a cellulose cartridge section for "polish-

* Sponsored by ASLE Technical Committee on Lubrication Economics.

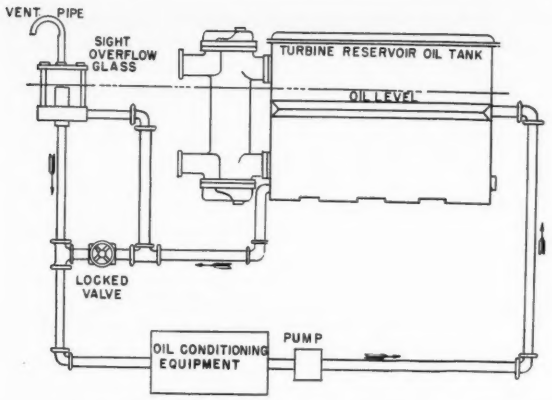


Fig. 1
Typical Oil-Conditioning System *(Courtesy General Electric Co.)*

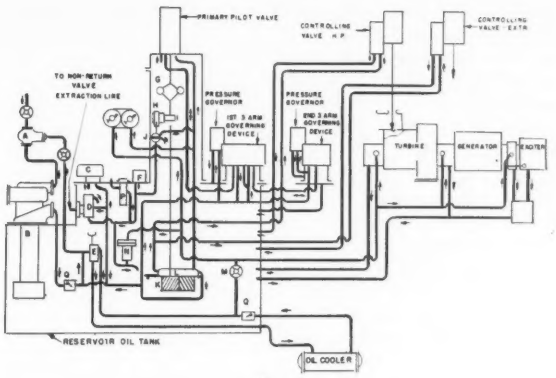


Fig. 2
Piping Diagram of Industrial Turbo-Generator
(Courtesy General Electric Co.)

** KEY **

A—Auxiliary Oil Pump Regulator
B—Auxiliary Oil Pump
C—Steam Seal Regulator
D—Trip Valve for Non-Return Valve
E—3-Way Valve
F—Throttle Trip Cylinder
G—Speed Governor
H—Emergency Governor
J—Emergency Trip Device
K—Relief Valve
L—Main Oil Pump
M—Bearing Pressure Valve
N—Low Oil Pressure Valve
P—3-Way Mech. Trip
Q—Non-Return Valve

ing" the oil are commercially available. The use of activated earth filters is not recommended since they will remove the rust inhibitor and in some cases the oxidation inhibitor from the oil. Water washing is also not recommended for the same reason. However, if noninhibited oils are used, clay filters and water washing have merit in maintaining low acid values and removing water-soluble deterioration products. Caution must be exercised though to retain the acid value at a sufficiently high level to permit the presence of polar-type deterioration products which can act as rust inhibitors.

Turbine Lubricants

The lubrication of any turbine requires the continuous supply of clean, moisture-free, air-free, cool oil to the:

1. Bearings—main and thrust.
2. Governor system.
3. Reduction gears.
4. Flexible couplings.

The design of the main lube system and auxiliary filtering equipment (See Fig. 2.) will provide the foregoing, but the oil itself must have the following characteristics to assure maximum oil performance:

1. Proper viscosity at all normal operating temperatures.
2. Provide a boundary film by "wetting out" on bearing surfaces.
3. Oxidation resistance.
4. Prevent formation of rust.
5. Minimum tendency to foam.
6. Allow rapid separation of water and solids.
7. Sufficiently high flash and fire point specifications.
8. Uniformity of product.

Viscosity

The viscosity recommendations for various type units are shown in Chart 1. However, these limits are only general, and the operator should follow the manufacturer's recommendation for a particular unit.

CHART I
STEAM TURBINE LUBRICANTS
RECOMMENDATIONS

Ambient Temp. —40-125F.
Oil Temp. —100-180F.

	S.S.U. Viscosity	
	100 F.	210 F.
1. Direct-connected—Pressure Circulation	150-200	
2. Direct-connected—Ring-oiled—Water-cooled	300-350	
3. Direct-connected—Ring-oiled—Not water cooled		70-75
4. Direct-connected—Ring-oiled—Bearings integral with case—Not water-cooled		85-90
5. Geared—Pressure Circulation	300-350	
6. Geared — Ring-oiled — Water-cooled — Gears—Oil Bath	300-350	
7. Marine Direct-connected—Pressure Circulation	300-350	
8. Marine Geared—Pressure Circulation	400-560	

Oxidation Stability

The stability of a turbine oil is obtained by the blending of a carefully selected base stock and a satisfactory oxidation inhibitor. However, the service life of the oil is dependent upon the conditions under which it must operate, viz., operating temperatures (unit and ambient), moisture, aeration, metallic components of the system, contaminants, and used oil. The effect of

these factors can be materially reduced by proper maintenance procedures.

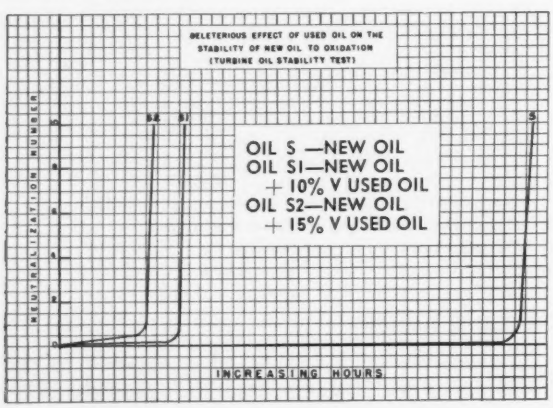
The operating temperature, that is, the bulk oil temperature, should be maintained at the manufacturer's recommended value to insure proper lubrication without adversely affecting the stability of the oil. All mineral oils are affected by temperatures, the higher the temperature the shorter the service life. It has been shown experimentally that the oxidation rate is doubled for each 18-20 F. rise in temperature; thus, increasing oil temperatures from 170 F. to 188 F., under normal conditions, could conceivably halve the life of the oil. However, it must be borne in mind that correlation in service with laboratory results is difficult, since there are other contributing factors that affect the stability of a lubricant.

It has been proven that water is the greatest deterrent to good lubrication in any system. Oxidation can be accelerated as much as 1000% by the presence of water. Furthermore, it causes rusting, forms oil-water emulsions, tends to leach out the rust inhibitors, and assists the acids in attacking the metallic surfaces.

Aeration of an oil permits the intimate mixing of air and oil, with the result that oxidation is greatly accelerated. In geared turbines this is more of a problem than in direct-connected units. This detrimental effect can be considerably curtailed by allowing the oil a "rest period" during which air can be released.

Many of the contaminants present in the atmosphere or in the unit itself may also shorten the oil life. The former usually are fly ash, dirt, dust, and chemicals common in industrial plants, while the unit itself may contain rust, water, rust-preventive compounds, graphite, and compounded fatty oils.

Finally, old highly oxidized oil has a deleterious effect on the life of new oil. Laboratory analysis correlated by field experience indicates a 10% blend of used (deteriorated) oil with 90% new oil will result in approximately 75% reduction in the stability of the new oil. (See Fig. 3.)


DELETERIOUS EFFECT OF USED OIL ON THE STABILITY OF NEW OIL TO OXIDATION (TURBINE OIL STABILITY TEST)
OIL S —NEW OIL
OIL S1—NEW OIL + 10% V USED OIL
OIL S2—NEW OIL + 15% V USED OIL
NEUTRALIZATION NUMBER
INCREASING HOURS

Rust Prevention

Present day turbine oils are inhibited to prevent the formation of rust on those areas normally bathed by the oil. In brief, the action of the inhibitor is one of deposition of mono-molecular polar-type films on the metallic surface, which hinder the effect of water on this surface. Rusting can be in the form of either the common red rust or the black magnetic type. The former is caused by the action of moisture or vapor on surfaces above the oil levels. The latter is found in those areas of a system that are covered by the oil where the temperatures are elevated, and the presence of oxygen and moisture is limited. This type is usually found in closely fitted areas, such as the bearings, and governor mechanism. The use of a proper lubricant will, in most cases, control the formation of black rust, while red-rusted surfaces can be protected by painting with an oil-water insoluble coating. However, there have been many cases where red rusting has been materially reduced in systems using inhibited turbine oils.

Since rust-inhibited oils effectively protect only the surfaces bathed by the oil, it is often necessary to coat those areas above the oil level to prevent the formation of rust caused by condensation of moisture and volatile products. The above-mentioned oil-water insoluble paints, of which there are quite a few commercially available, have been found to be very satisfactory. Manufacturers now supply sump tanks, bearing pedestals and other nonfrictional areas, factory painted with one of these materials. It has been found that the surface must be thoroughly cleaned and dried before applying these paints, and the paint itself completely hardened before exposure to warm oil. If these precautions are not followed, blistering, peeling, and actual stripping of the paint may result.

Separation

The rapid separation of water from oil is of paramount importance in any circulating system. Many tests are presently used to indicate this characteristic but in the majority of instances laboratory evaluations and field performance do not correlate to any great degree. Poorly refined oils containing organic soaps or water-soluble materials tend to hold suspended water. On the other hand, rust-inhibited oils when new will, in some cases, also retain a slight trace of moisture to the point where the specifications (usually written for straight mineral oils) for steam emulsion number, demulsibility, etc,. cannot be met. In service, however, the gradual "plating out" of the rust inhibitor results in improved emulsion values. This fact should be borne in mind when considering inhibited oils.

Cleaning of Turbine Lubrication Systems

The subject of turbine cleaning has been the subject of much debate for a considerable period of time. Some authorities feel that the use of special flushing oil is unnecessary, while others consider it of utmost importance. Actually, both are correct if one considers the condition of the unit in question. The large units shipped disassembled, and erected on the site, have been satisfactorily flushed with the regular turbine oil. This flushing removes dirt, dust, core sand, loose rust and other solid contaminants that may have found their way into the system. On the other hand, small packaged units shipped with the oil system coated with a rust-

preventive (insoluble in regular turbine oil) normally require a special flushing oil for its complete removal. The same is true in units that have operated on highly oxidized oil. Whatever material is used for flushing it is agreed that any contaminant that may impair the functions of the oil or shorten its life expectancy should be removed from the system. In short, a clean system should be prepared for the new, clean oil.

Special turbine flushing oils now commercially available have high solvency for oxidation products, incorporate additives for the removal of sludges and moisture and include a rust preventive for protection of the newly cleaned surfaces. The use of petroleum oils for flushing has the following advantages:

1. Eliminates system dismantling.
2. Limited auxiliary equipment required.
3. Excellent solvency for normal sludges and rust preventives.
4. Protects newly cleaned surfaces against rusting.
5. Small percentages do not affect stability of the turbine oil.
6. Nontoxic and chemically inactive.
7. Stringent safety precautions unnecessary in handling and using.

Recommended procedures for cleaning turbines have been published by the D-2 Committee of ASTM and the ASME. In any case, the method to be used in flushing a particular unit should be decided upon by the operator, the turbine builder and the oil supplier. Normally, after inspection, sufficient flushing oil is placed in the system to maintain circulation without losing pump suction. In some cases the bearings, gears (if present) and the hydraulic mechanism are by-passed; in other instances, they are not. The oil is heated to approximately 140 F. to 160 F. circulated and filtered until the filters are clean and inspection of various points of the system indicates contaminant removal. The oil is then completely drained from the system (pump, coolers and low spots in the lines). The sump should be cleaned by hand to remove all traces of oil and settled solids. A charge of oil, either the same viscosity as the running charge, or intermediate between the flushing oil and the operating oil, is placed in the system. The same procedure is then repeated. As soon as a final inspection of the critical areas shows the unit to be clean, this oil should be removed and the regular operating oil should be put into the system. This oil should be circulated cold for a short period to assure that all cleaned surfaces have been thoroughly bathed. A scheduled daily circulation should be followed until the unit goes on the line.

Oil Sampling and Testing

One of the most important factors in an oil maintenance program is the proper sampling and testing of the system lubricant. Some companies having their own laboratories conduct the tests while others will depend upon the lubricant supplier. In most cases the supplier offers this service with the sale of the turbine oil. The oil is sampled approximately every 6 to 9 months, using satisfactory containers, then analyzed, and the results reported to and discussed with the operator. It is good policy between the sampling dates, to make an occasional visual check of the oil. The comparison of the used oil with new oil will indicate the presence of color bodies, water, and solid contaminants.

The laboratory tests normally run are Saybolt Viscosity at 100 F., Flash Point, Color, Appearance, Water, Neutralization Value, Saponification Number, an Emulsion test and Interfacial Tension. These tests will show what change, if any, has occurred in the oil since the last test, but they will not indicate whether or not the oil is fit for further use. If a question arises as to the test results it is well for the operator to discuss any discrepancies with the oil supplier.

In conclusion, the premium turbine oils in use for the past decade have given outstanding performance. Operational records show that 100,000 or more service hours can be obtained on one charge of oil with minimum make-up. However, to achieve those results the operator must carry out a continuing oil maintenance program.

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AUTOMOTIVE DRAWING COMPOUNDS— SPECIFICATIONS AND APPLICATIONS*

by J. T. O'Reilly

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From 1934 to 1941, he was engaged in analytical testing in the Ford Motor Company laboratories.

During the war years he was in charge of rubber and plastics quality control and development at the Willow Run Bomber Plant.

Post war, Mr. O'Reilly has been responsible for non-metallic materials specifications and applications at the Ford Motor Company, where he is now Supervisor of the Chemical Unit of the Manufacturing Research Department.

Scope

In this brief outline of specification and application practices in the industry, drawing compounds are defined as lubricants which are employed to facilitate the forming of metal. Emphasis will be on the practice of lubrication in press forming operations on low carbon steel, since this constitutes the biggest production volume in the industry.

Methods of Evaluations

The trend in material specifications, generally, is toward performance requirements which correlate with production conditions, and away from a required chemical analysis. We would like to be able to tell a supplier, "You can supply green cheese to this specification, if it possesses the required laboratory performance requirements." In a large measure, this objective has been approached with some materials and the glowing reports available in the literature on laboratory machines for measuring the coefficient of friction, film strength, etc., would indicate that it must certainly be true of drawing compounds. However, the best indication of the automobile industry's small regard for these testers is the fact (disconcerting to a specifications engineer) that most automobile manufacturers do not have any drawing compound specification at all, but depend entirely upon shop trials.

This dependence upon shop trials is unfortunate because of their very real limitations. There are more production variables than even the average production superintendent appreciates. The shop is not very tolerant toward thorough shop trials that can interfere with production rates, no matter how promising the ultimate goal. When a new compound is being tested, the supplier's Service Engineer often assists and much good can come from this practice. However, one must remember the Service man is also a salesman and his primary purpose is, naturally, to see that his product shows up to best advantage. Further, quite often the hard-pressed production foreman is not thorough enough to see that the reference material is used correctly as a control.

However, since shop trials are so vital and since we can't take the shop into the laboratory, we must try to take the laboratory into the shop by assigning sufficient competent engineering-minded personnel to do the job and have them follow definite test procedures. Practice varies in the industry, with shop trials being the responsibility of an appropriate technical group such as quality control laboratory (as is generally the case at Ford's), master mechanic, plant engineer, production superintendent, tool stores department, or tool and die engineer.

Since tools (draw ring, tension, etc.) on a given job have been adjusted for optimum results with the regular drawing compound, tool adjustments may be necessary when trying a different type of compound. Care should be taken that surface smoothness and other properties of both the stock and tools are the same for comparative tests. Method of lubricant application and degree of dilution, if any, should be duplicated. Definite standards of performance are necessary and should include a rating on such items as per cent of scrap, pieces prior to scratches (that can be felt by the fingernail), and pieces between re-working of tools, etc. Figures based on an average of two or three production runs, including a re-run of the material used as a control, are desirable.

We have found it advantageous to use a touch pyrometer to check the metal temperature of a part in a critical area immediately after removal from the press. Temperatures 10 F. above normal often indicate trouble ahead.

In evaluating an experimental drawing compound, a blank is frequently scribed to provide 1 inch squares, and the drawn object cut in sections so that both variation in metal thickness as well as distortion of the squares can provide data showing the effect of the drawing compound on metal flow. Incidentally, these same techniques are also applied in the study of new part designs and new tool adjustments.

Besides the direct benefits to the lubricant user, laboratory performance tests naturally aid suppliers of drawing compounds (who cannot maintain sheet-metal press-production lines for such work) and give them necessary information for tailoring their products to meet the exacting (and changing) demands of industry. There appears to be a trend away from witchery involving secret ingredients and compound techniques and more of a willingness to agree that the compounds can be classified according to type.

Properties

Drawing compounds represent a compromise of many properties. The customers' particular problems (and special peeves) influence the priority given the

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different performance properties selected for screening out the most promising new compounds for test. For example, the emphasis in recent years on cleanability, and on weldability without cleaning, has sometimes unduly reduced drawing efficiency.

Properties we look for in a drawing compound are:

1. *Adequate drawing qualities* or friction control. We say "control" because, although low friction is generally desirable, if it is too low, an undue slippage may cause excessive buckling and breakage on some applications.
2. *Application requirements*—Is mixing required on the job? Can the drawing compound be sprayed as well as brushed, dipped, or roll coated?
3. *Stability*—Does the drawing compound settle out, become rancid on storage or deteriorate on freezing?
4. *Toxicity*—Are toxic fumes liberated? Does the drawing compound cause dermatitis?
5. *Weldability*—Can unwashed, formed panels be resistance welded satisfactorily (even after storage over a week-end)?
6. *Rust Protection*—Is the drawing compound itself corrosive, requiring prompt removal? Does it offer enough rust protection so that formed parts can be shipped to assembly branches (10-day indoor storage typical), or must it be removed and a rust preventative applied?
7. *Washability*—Is the drawing compound readily removable with a mild alkali or emulsion cleaner, or is solvent cleaning and/or mechanical abrasion also required?

Ford Material and Process Specifications

A Ford "M number" or material standard is assigned to materials used by the Ford Motor Company. This number serves to identify the material for stock purposes and it appears on corresponding material specifications. A typical Ford drawing compound specification, M-13884-E, Water Emulsion Draw Compound, is shown.

Water Emulsion Pigmented Draw Compound for Extra Heavy Drawing

1. SCOPE

The material desired under this specification is a Water Emulsion Pigmented Heavy Duty Draw Compound suitable for use as a lubricant in deep drawing such parts as roof panels, flywheel housings, and tractor instrument panels.

2. REQUIREMENTS

2.1 Composition—The material shall be composed of a combination of oils, fats, and a pigment compounded to produce a material smooth in appearance and free from coarse particles.

Material possessing the following characteristics has been found satisfactory:

Soaps	22%
Water	50%
Pigment (Calcium Carbonate)	28%
Pigment Particle Size	325 Mesh
Color	Light Tan
Odor	Neutral
Consistency	Paste
Weight per gallon	9.9 lbs.

2.2 Quality—Production shipments shall be equivalent in quality to the original approved purchase sample when subjected to laboratory and production tests.

Suppliers shall obtain approval prior to making any change in the formulation of the materials supplied under this specification.

Note: The material must be free of all foreign impurities such as dirt, wood, etc.

2.3 Application—The material shall be suitable for application either by brushing or spraying.

2.4 Mixture Ratio—The material shall be of the same consistency as the original approved purchase sample and shall be suitable for mixing in various ratios with water. A typical mixture ratio is two parts of material to one part water.

2.5 Grain Size—100% shall pass thru a 60 mesh screen.

2.6 Pliability—The material shall remain pliable after application and shall not harden.

2.7 Drawing Properties—The drawing properties of the material shall be equivalent to the original approved purchase sample.

2.8 Stability—The material shall show no signs of separation, hardening, or caking nor shall it turn rancid, while standing, during normal storage periods.

2.9 Toxicity—The material shall be free from toxic fumes and shall have no tendency to cause dermatitis.

2.10 Weldability—The spot welding qualities of the dried film shall be equivalent to the original approved purchase sample.

2.11 Rust Protection—The rust protection properties of the dried film shall be equal to the original approved purchase sample.

2.12 Cleaning—The material shall be easily removed by the methods described in MS-9-1 under procedure "B" and "C".

2.13 Acceptance—This specification is not intended to limit the composition or method of manufacture. Material submitted to this specification will be given a practical shop test on a comparison basis against the original approved material and will be valued, by the Quality Control Laboratory, in general, upon these results. The Quality Control Laboratory conducting the tests shall acknowledge a new vendor with written approval to Purch. and to the Spec. Sec. of the Mfg. Res. Dept.

In our drawing compound specifications, the chemical analysis of the initially approved product is given as a general guide to help classify it, but the final approval is contingent on its passing a rigid shop trial successfully. Chemical analysis of production shipments from all sources is required to be the same to that obtained on the approved purchase samples from the same source as a check on uniformity of material and on value received.

Ford process specifications give approved methods of using materials in a manufacturing process. The title page and a typical page from the text of Specifications MS 11-1, Application of Draw Compounds are reproduced. This specification assists supervision in seeing that the right amount of the specified drawing compound is used on the job and is correctly applied. It is a valuable reference in conducting shop trials.

Application of Draw Compounds

1. SCOPE

This specification covers the methods of application of Drawing Compound used in producing current production parts.

2. METHODS OF APPLICATION

Drawing compounds are used as received in most cases but they can be used with water or with oil or in combination with both. Dilution of drawing compounds depends upon the depth of draw, stock and manner of application. Blanks shall be free from grit, metal chips and shop dirt when compound is applied.

2.1 Spraying—Spray guns with a No. 4 opening are used in most spraying operations. Air line pressure and atomizing pressure should be not over 5 lbs. more for compounds used as received than for compounds that have been diluted.

2.2 Brushing—Apply the desired drawing compound to the blank and die according to proven methods with suitable brushes applicable to reach the critical area.

2.3 Rolling—Pass blanks through rollers coated with drawing compound so that both sides are completely covered.

2.4 Dipping—Coat the entire surface area of the blanks by submerging completely into the desired drawing compound.

APPLICATION CHART (Partial List for Illustration)

Part No.	*Part Name*	*Compound*	*Amount Per Panel*	*Method of Application*	*Remarks*
1A-1130A	Ford Hub Cap	M 1083	0.99 oz.	2.4	Use as is.
1M-1137A	Mercury Hub Cap	M 1083	0.99 oz.	2.4	Use as is.
8A-6044	Ford Front Fender Apron	M 13884A	0.56 oz.	2.1	Spray entire blank area with one gun.
8A-6394	Flywheel Housing	M 13884E	0.57 oz.	2.3	
1HA-16013-4	Ford Front Fender	M 501	0.10 oz.	2.2	Mix compound with 1 part water and brush bead and radius areas of die and blank.
		M 13884F	0.10 oz.		
		M 13884A	0.202 oz.	2.1	Use as is. Spray headlight area with one gun.
O1A-16615	Ford Hood	M 13884J	0.168 oz.	2.1	Spray nose area with one gun.
OA-7002044	Cowl Side	M 501	0.126 oz.	2.2	Mix compounds together and cover entire blank.
		M 13884F	0.126 oz.		
OA-7020220-1	Inner Door Panel	M 584A	0.66 oz.	2.1	Mix 5 parts compound with 1 part water and spray entire area with four guns.
1A-7027934-5	Extension Panel	M 501	0.218 oz.	2.2	Mix compounds together and brush on bead areas of die and blank.
		M 13884F	0.072 oz.		

Correct application of drawing compounds cannot be over-emphasized. Sometimes management which is quite impressed by a 10% difference in cost per lb. between two drawing compounds, is indifferent to the use of 500% more compound than required on a given job. Automatic application (spray, injection, dip or roll coat) is becoming more prevalent because, in addition to reducing labor cost, it assists in obtaining a consistent quantity in the right place. In illustration of this trend, Figures 1, 2 and 3 show typical applications of drawing compounds to fenders, door panels and hoods, respectively.

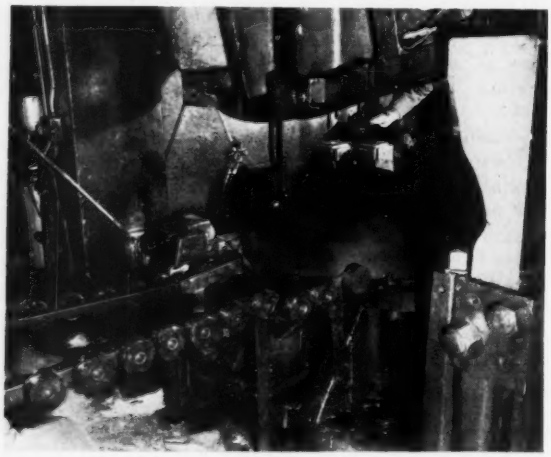

Fig. 1
Automatic Spray Application of Drawing Compound to Fender Blank

Selecting the Correct Type of Drawing Compound

At a first glance, it might appear practical to tabulate automotive parts such as fenders, roof panels, etc., and give the corresponding drawing compound type used by the industry. However, even if all manufacturers started with identically designed plaster models, practices in dividing the car into parts for manufacture vary so much among body and tool designers that depth of draw and degree of unequal drawing on a part, and occurrence of sharp corners on the tool, would vary considerably. These differences are, of course, reflected in the different requirements in drawing compounds for superficially identical draws. The severity of draw is a function of the yield strength of the metal;

Fig. 2
Automatic Spray is Here Supplemented by Spot Brush Application

Fig. 3
Four Automatic Guns Spray Lower Die & Blank in This Inner Door Panel Press

the coefficient of friction, surface smoothness, and degree and distribution of draw.

The most prevalent types of drawing compounds used are:

1. For mild draws and simple bends, dilute aqueous soap solutions or straight mineral oils are generally used.

2. For medium drawing, addition to mineral oils of polar materials, such as fatty acids or other source of polar compounds, or sulphurized oils, is common.
3. For severe drawing, finely divided fillers, such as calcium carbonate, clay, or lithopone are often added to the polar compounds and chemically reactive compounds containing sulphur or chlorine are sometimes used.

This listing is, of course, an over-simplification because dozens of combinations, including low-melting solids, metal coatings and emulsifying agents other than soap, and dry soaps and plastics, have been used in special applications.

On the job, the order of preference will not always be in the order of drawing efficiency because consideration must also be given to washability and other properties previously listed, as well as to price.

Since there are obvious advantages in keeping the number of compounds on hand to a minimum, products that can be diluted with water and/or oil in different concentrations, depending upon the application, and that are adaptable to available application equipment, have definite advantages.

While dry-coating-type compounds eliminate the mess usually found around presses using wet compounds, they have not been used generally on sheet metal for several reasons. Special facilities are required for coating and drying the blanks. Drawing quality is not the best possible because there is little cooling action. In some operations, the dry coating piles up on the tools. Finally, humid weather changes some of these coatings to a tacky condition which complicates handling and may reduce drawing efficiency. We do use a dry, sodium borate soap-type compound in the manufacture of drawn rear axle housings where layout-space for the new installation which was required permitted room for the necessary equipment. In this case, after alkali cleaning, the tubes are dipped in a 200 F. soap-borax water solution and dried. Concentration of this solution, which is controlled by titration, affects the length of housing obtained in the subsequent drawing operation (Figure 4). In another dry coating operation oil pan blanks are automatically spray coated (Figure 5) with a soap-wax solution and dried and stacked on pallets. The pallets are transferred as required with fork trucks to the blanking and drawing presses.

While there are indications that phosphate coating of stock with marginal physicals will reduce scrap in drawing body stock (probably because a better surface is provided for drawing compounds), it is generally more practical to use such marginal stock on less difficult draws than to go to the additional operation. Since much of the phosphated surface would be removed in later metal finishing operations, it would not replace the phosphating usually applied prior to painting.

One automotive application in which phosphate coating has shown definite advantages is in the forming of bumpers. Automatic polishing steel in strips before forming bumpers greatly reduces costs because the set-up does not have to be changed to accommodate designs of different customers or to provide for model changes. The following sequence of operations is typical:

1. Polish strips in the flat.
2. Alkali clean.
3. Phosphate coat (Zinc phosphate spray).
4. Lubricate (usually dry-soap type film).
5. Blank.
6. Draw to shape.
7. Alkali clean or acid pickle to remove phosphate coating.

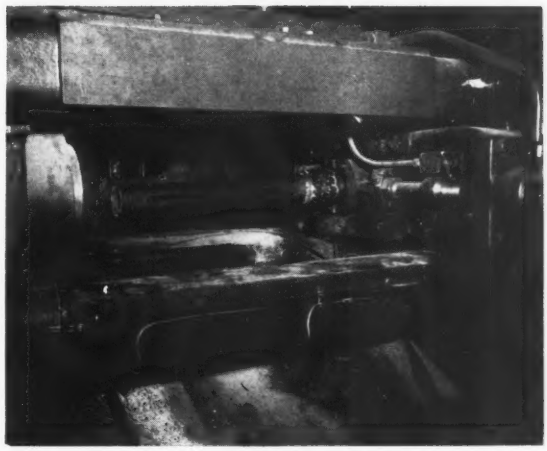

Fig. 4
First Drawing Operation of the Ford Rear Axle Housing

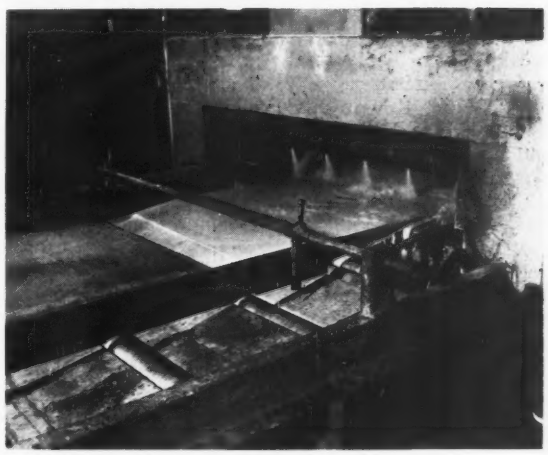

Fig. 5
Automatic Spray Application of Soap-Wax Coating to Sheets from Which Oil Pan Blanks Are Sheared

8. Continue with conventional plating cycle.

The phosphate coating minimizes scratches due to handling the polished sheet and increases the efficiency of the lubricant as a drawing compound and as a rust preventative. When it has served its purpose the coating is removed in the first stages of the regular plating cycle.

Before steel wire is cold drawn for use in making bolts, etc., the acid pickled coils are coated with lime by immersing them in a water-lime slurry and drying. At the Ford Motor Company the wire is then drawn through draw boxes lubricated with a mixture consisting of one part aluminum stearate and two parts lime. Besides providing good drawing qualities, a residual film of this material is retained on the drawn wire which minimizes scoring in the bolt machine in the subsequent cold-heading operation.

To summarize: Much progress has been made in recent years in developing new compounds, and better controlled methods of testing and using them. Although present material specifications leave much to be desired, increasing interest is bound to result in better laboratory performance tests and a clearer understanding of the principles involved in specifying drawing compounds.

The author wishes to express appreciation to Messrs. W. Duey, H. Novack and J. Tauber of the Ford Motor Company, for assistance in obtaining data for this paper.

LUBRICATION IN THE TEXTILE INDUSTRY*

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I. Lubrication Problems in the Textile Industry

A. Introduction

The textile industry may be the oldest industry in the world. Since the Pastoral Age about 3000 B.C., it became mechanized slowly by the following events:

In 1733, Kay invented the flying shuttle loom in England. In 1748, Wyatt invented the revolving cylinder card and in 1765, Hargreaves invented the first workable spinning machine, called a *Jenny*. The year 1770 saw the advent of the spinning frame by Arkwright. In 1774-1779, the first improvements on these machines were made by Crompton's adding drawing rolls to the Jenny and Cartwright added steam power to the spinning frame. In 1794, Whitney invented the cotton gin. In 1832, Jencks invented the first ring spinning frame. (The dates in the foregoing paragraph have been verified to the best of the author's ability.)

No radical changes have been made in manufacturing processes since, although considerable improvements have been made to effect much higher production. Most of these improvements established methods of mass production which are widely used in every industry today. Few people realize that the textile industry was first to utilize mass production. The industry today is the world's largest. Considering all those who work with textiles, from the cotton grower and sheep rancher to the cutter and tailor, this industry employs 1/5 of the world's working population. The textile industry ranks fourth in the United States in the value of the products produced.

Keeping step with the improvements in manufacturing processes, the manufacturers of textile equipment have made many improvements in the bearings, gears, and the lubrication of textile equipment. However, the need still exists for additional improvements in both the provision for and methods of lubrication.

II. The Basic Problems of Textile Mill Lubrication

A. Types of Bearings and Fits

Probably the most serious bearing problem is that of surface finishes and fits. The majority of parts on textile equipment have a rough surface finish. The bearings and other surfaces are not tooled to adequate operating fits.

B. Bearing Seals

In spite of the fact that the bearing fits and rough surfaces call for a lubrication application which will allow the lubricant to remain in the bearing, many bearings are improperly sealed or have no seal provision at all.

C. Gears

The gears on many textile machines have excessive backlash. Few of the gears on these machines have provision for adequate lubrication.

D. Personnel Training

The fourth phase of lubrication is a responsibility that is directly that of the plant management—adequate training of personnel to insure proper lubrication of equipment.

E. New Machinery

The fifth point is again the responsibility of plant management and is perhaps due to the fact that the textile industry is probably the most competitive industry in the world. In drawing up specifications for new equipment, many times the equipment had to be made and purchased at the lowest possible initial cost. The provisions were often made by individuals who were not familiar with bearing application and lubrication problems and the buying was done almost 100% on a price basis.

III. Textile Mill Lubrication

A. Bearings

Surface finish plays a major part in consideration of the lubrication of any machine. The type of machine finishes and manufacturing tolerances of bearings and journals is of maximum importance. Where rough or very smooth surface finishes are running together, an oil wedge throughout the operating cycle of the parts is absolutely necessary to prevent gauling, tearing, and seizing of the parts. The oil wedge between two running parts can only be maintained by retaining a sufficient volume of lubricant between the parts. Without seals, as part clearances increase, the required volume of lubricant to maintain an oil wedge increases because of leakage through the low pressure area. In the textile industry, the majority of machine parts have rough surface finishes, rather large clearances between mating parts, and few seals. This presents a most difficult lubricating problem, since practically all of the lubrication is performed manually. Thus, the basic lubrication

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problem of the textile industry becomes one of supplying sufficient lubricant economically to machines containing poor surface finishes and large clearances.

Following are two suggestions as to the solution of the lubrication problem of textile equipment now in use. First, the manufacturers of lubricants can utilize their knowledge in the development of both oils and greases which will assist in maintaining a constant oil wedge in textile machinery. More specifically, there are many bearings found in looms which carry heavy shock loads. Since these bearings are plain cast iron bearings and have fairly large clearances between the cast iron bearing surfaces and the steel journals, it has been almost impossible to prevent metal to metal contact when the shock loads occur. This is perhaps due to the combination of the lack of film strength in the lubricant and the large bearing clearance. Some of the lubricating manufacturers had developed through their research certain types of oils which have excellent adhesive properties and a high film strength. This type of lubricant has proven to be very successful in preventing metal to metal contact during the shock loads found in looms. Since the Weave Room represents a greater portion of textile mill machinery maintenance and lubrication cost, a lubricant of this type will be of great benefit to the textile industry in the reduction of the cost of both lubrication and maintenance. Already, some of the lubricating companies have devoted much research in assisting the textile industry in many problems of lubrication. However, much is still to be desired. Certainly, the oil companies can be of great assistance to the textile industry by developing lubricants which will give maximum performance under present operating conditions. However, this will not be the complete solution to the problem, since there are limitations relative to the changes which can be made in oils by the use of additives.

The second suggestion to the solution of the problem lies in the ability to adapt mechanical applicators to the machinery now in operation. For example, in many cases, a pin bottle oiler has been used to supply lubricant to the main cylinder bearings on carding machines. Prior to the use of pin bottle oilers, the bearing was lubricated manually, once a day. However, after installation of the pin bottle oiler, it was necessary to refill the bottle only once every three weeks. There are many points of lubrication on opening, picking, carding, roving, spinning, and weaving equipment which are readily adaptable to either a pin bottle oiler, pressure fittings, wicked cups, or other mechanical methods of lubrication which will result in savings of lubricants, labor, and machine down time. The use of electric or pneumatic spindle applicators on spinning frames will provide faster and cleaner lubrication than the manual method of application used today.

There is much discussion in the textile industry of the use of the so-called centralized lubricating systems. These systems have been purchased on spinning frames, slashers, and some finishing machinery, and have been very successful in providing continuous lubrication to the bearings. The use of this equipment on looms now in operation is very difficult to justify because of the present high material and installation cost. However, the purchase of these on new weaving equipment could be an excellent investment provided the systems were economically designed and properly maintained during the operational life of the loom.

Although some of the more progressive textile organizations have made a large number of mechanical applicator installations on their present equipment, this method of lubricating machinery has not been widely accepted throughout the industry. This is perhaps due to the high initial installation cost. In many cases, the application of mechanical lubricators means the removal and machining of parts. Generally, the labor and machine down time required for the installation of mechanical applicators on present equipment is rather costly. At times, it is difficult for textile management to comprehend the full savings which can be derived from the use of these applicators on textile machinery. Often the initial cost is so high that a period of time must elapse before any actual dollar savings are realized.

B. Bearing Seals

As previously mentioned, a large number of bearings in the textile industry have inadequate or no seals to assist in holding the lubricant in the bearing. Where large bearing clearances exist as in the textile industry, it is impossible to maintain an oil wedge without some method of retaining the oil inside the bearing. Since bearing pressures are greater at the center of the bearing than at the outer edge, the oil rapidly flows to the edge of the bearing and frequently drips to the floor. This accounts for the oily appearance of many textile machines and mill floors. The lack of sealed bearings on textile machinery today can be attributed to the management of the industry and the machinery manufacturers. The textile machinery manufacturers have been forced to sacrifice proper provision for lubrication for low machine cost because the textile mill management has required low initial cost machinery. Therefore, the correction of this problem is a two-fold responsibility. First, textile management must recognize the importance of proper lubrication and the large maintenance labor and shut down savings which can be made by the provision of proper lubrication on original equipment. Secondly, the textile machinery manufacturers must redesign their present machinery with the proper sealed provision for excellent lubrication of all moving parts. It is perhaps well to point out that in cases where the machinery manufacturers have already provided sealed bearings, a large percentage of the bearing seals are blown by improper application of the lubricant to the bearing. It is not only the responsibility of the textile mill but also the responsibility of the machinery and lubricant manufacturers to teach the personnel applying lubricants to textile machinery the proper methods of lubricating sealed bearings. This is necessary so that designed lubrication will be properly utilized once it is in operation on the machine. There are few bearings on present machinery in operation which can be sealed without considerable design changes. However, the machinery manufacturers may well consider the redesign of replacement parts to provide for proper lubrication of their machinery now in operation. At the same time, textile mills should search their machinery and adapt standard seals available on the market to all possible bearings.

C. Gears

Few textile gears operate in a bath or receive the benefits of splash lubrication. The majority are open gears which must be lubricated manually. There has been much progress made in the design and production of these open gears on textile machinery in the last ten years. Many gears, formerly cast tooth, have now become cut tooth gears. Although the cost of cut tooth gears is greater than that of cast, they have contributed much to the elimination of many maintenance problems formerly encountered.

The basic problem affecting gear lubrication on textile machines is the large gear backlash and the reversal of drive in operation which causes impact loading of the gear teeth. Naturally, large backlash is expected on cast tooth gears. However, some of the textile machinery manufacturers have apparently overlooked the great importance of proper gear meshing of cut tooth gears in relation to gear wear and lubrication. There are numerous cut tooth gears on new machinery that are improperly meshed. In addition, the textile mills have few men who understand the proper methods of meshing gears.

Considering this, the requirements for gear lubricants in the textile industry are great tenacity and high film strength. Otherwise, the lubricant will be forced off the edge of the gear. An excellent example of the operation of the gears in textiles is the loom drive gear and motor pinion. During the loom cycle, the motor drives the loom and then for a short time interval the loom drives the motor. Thus, the driving direction of the gears is reversed and the backlash which usually is more than that of the generally accepted standard is absorbed and shock loading occurs. This action occurs 50,000,000 or more times per year. Recent studies made by both mills and machinery manufacturers in cooperation with the lubricant companies have revealed that gear wear can be greatly reduced by the use of high film strength and tenacity lubricants rather than the straight mineral oils and greases which are used today throughout the textile industry.

IV. Management's Problem

A. Personnel

The textile mills have sadly neglected the lubrication of their machinery. Usually, the supervision of each department has been made responsible for the selection of the lubricants, oilers, and the methods of lubrication for the production machinery. In most cases, this supervisor, although he may be an excellent production man, does not understand the simple and fundamental principles of lubrication. However, management has absolutely no provision for training the supervisor for one of the most important phases of his responsibility. This, of course, results in mis-application of lubricants, poor methods, and generally haphazard lubrication. In addition, the mills usually place oilers in the lower wage scales and use personnel that have no knowledge of lubrication or training in proper application. Perhaps this situation is the result of textile mill management's lack of understanding of the importance of proper lubrication.

B. Maintenance

The relationship of lubrication to production, cost, and maintenance is of great importance. Poor lubrication, whether it be the result of lubricant mis-application or poor methods of application, will result in machine part metal to metal contact. This means part wear and many mechanical breakdowns with a corresponding interruption of production and high labor and spare parts costs. On the other hand, proper lubrication will minimize part wear and maintenance; thus, the maximum production can be obtained at a minimum cost. Proper lubrication is controlled lubrication. This can be obtained only by knowledge and the application of this knowledge to the machinery. Controlled lubrication can be obtained by any textile mill through the following process:

1. Training of supervision and lubrication personnel in the principles of lubrication.
2. Study and selection of proper lubricants for each machine.
3. Study of the methods of application of the lubricants.
4. Determination of the maximum frequency of application of the lubricants.
5. Study of proper storage and handling methods.
6. Consideration of the savings resulting from mechanical application.

This would result in optimum lubrication at minimum cost for any company.

V. Summary

In summarizing, the proper lubrication of textile machinery is the responsibility of the lubricant companies, machinery manufacturers, and the textile mills. In order to obtain the maximum benefits, these three must coordinate their efforts to the solution of the many difficult problems in the lubrication of both present and future textile machinery.

A. Lubricant Companies' Responsibility

More specifically, the lubricant companies must:

1. Assist the mills in the training of personnel.
2. Assist the machinery manufacturers in design of machinery for proper lubrication.
3. Develop new and better lubricants.
4. Offer competent service in the selection of proper lubricants to the mills.

B. Mills' Responsibility

The textile mills must:

1. Realize the importance of lubrication.
2. Insist on new machinery designed for proper lubrication.
3. Set up controlled lubrication.

C. Textile Equipment Manufacturers' Responsibility

The machinery manufacturers must:

1. Assist the lubricant companies with the lubricant requirements of the machinery.
2. Design for proper lubrication in all machinery.

Only through the complete cooperation and free exchange of information of all three units can great progress and improvements be made in the lubrication of textile machinery.

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A STUDY OF RUST PREVENTIVE PROPERTIES OF GREASES*

by R. J. Burger, B. Rubin and E. M. Glass

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His employment by the Reilly Tar and Chemical Corporation as a Research Chemical Engineer was interrupted by war service with the U. S. Army Corps of Engineers. Following that he was engaged primarily in organic syntheses as a Process Development Engineer.
He is at present employed as Project Engineer in the Materials Laboratory of the Engineering Division, Air Materiel Command, where he is engaged in research and development of aircraft lubricants.
He is a member of ASLE and A.I.Ch.E.

Mr. Rubin graduated from City College of New York with a B.S. in Chemistry in 1940, and from Ohio State University with an M.S. in Chemical Engineering in 1950.
In 1942 he entered the Air Force as a civilian instructor in ground maintenance of aircraft. During a four-year period he covered airframe and engine maintenance.
In 1946 he transferred to Materials Laboratory, Engineering Division, Air Materiel Command at Wright-Patterson Field. He was subsequently placed in charge of grease development and evaluation.
Mr. Rubin is a member of ASLE, ACS, and active in ASTM and CRC projects and government committees on lubricants.

Mr. Glass graduated from Rhode Island State College obtaining his Master's degree at Virginia Polytechnic Institute.
Entering the War Department in 1942 he was assigned to Wright Field as an aircraft maintenance supervisor working on fuels and lubricants problems. In 1945 the Army assigned him to the Materials Laboratory, Engineering Division, later appointing him Assistant Chief of the Petroleum Products Unit. Released from the Air Force he became Assistant Chief, Chemical Branch of the Wright Field Materials Laboratory, further assuming the duties of Chief, Petroleum Products Units. He presently is Chief, Plans Office of the Materials Lab.
Mr. Glass has been active in many organizations relating to lubricants and lubrication, such as ASLE, CRC, ASTM, ABEC-NLGI, and SAE A-6 Committee.

ABSTRACT

As a result of numerous complaints of corrosion of wheel bearings of aircraft in semi-storage conditions, an investigation into the rust preventive properties of wheel bearing greases was initiated. Concurrent studies were carried out in the laboratory and in service aircraft.
A laboratory procedure using ball bearings was developed which showed correlation with service results. The investigation was then enlarged to include many different types of greases. These included petroleum, diester, Ucon oil and silicone greases. Several factors influencing the degree of corrosion resistance were investigated. The effect of rust inhibition was noted.
The results to date indicate that certain properties such as high alkalinity and some water-emulsifiability with a degree of water resistance are useful in controlling the degree of corrosion protection which a grease affords to a coated bearing surface. In the case of diesters great difference in corrosion protective qualities exist among different classes of diester greases.
Finger print suppression appears to have a role in protection against corrosion of steel surfaces under service conditions.
The investigation is continuing. The factor of bearing rotation is being studied and an investigation of these greases in a tester employing dynamic conditions is underway.

Introduction

Approximately three years ago, the Air Materiel Command was besieged with an increasing number of Unsatisfactory Reports on the use of Specification AN-G-15 greases in wheel bearings. For the most part, the complaints cited considerable corrosion of the wheel bearings on both operational aircraft and airplanes which had been inactive for extended periods.

At the same time that the Air Force was experiencing these difficulties, the Navy likewise reported numerous instances of wheel bearing corrosion, mostly on stored aircraft when the bearings were lubricated with AN-G-15 greases.

A typical example of the condition of the wheel bearings being reported in the Unsatisfactory Reports is shown in Figure 1. The bearing pictured here had been removed from a C-74 type aircraft after 50 hours operation.

In view of these widespread corrosion difficulties arising from the use of AN-G-15 greases, the Air Materiel Command recommended the use of Specification AN-G-5a greases in wheel bearings as a "quick-fix" expedient until such time that further study could pro-

* Paper presented at 6th Annual Meeting, ASLE, Philadelphia, April 17, 1951. The statements expressed herein represent the views of the authors and do not necessarily represent the official opinion of the United States Air Force or the Air Materiel Command.

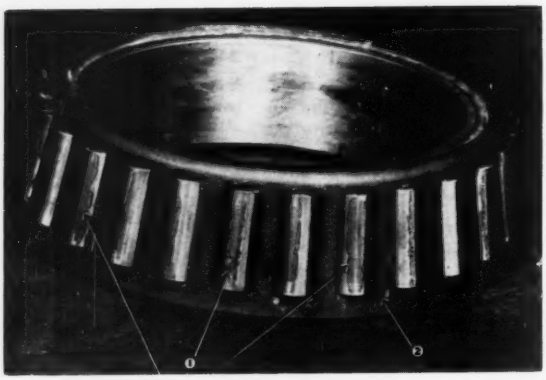


Fig. 1

Cone and roller assembly removed from C-74 airplane showing pitting and sub-surface corrosion

vide a more satisfactory answer to the problem. It was realized that the use of a high temperature lubricant such as AN-G-5 would substantially affect the low temperature operating characteristics of bearings. However, it was theorized that a slight increase in torque at low temperature could be tolerated in wheel bearings without causing undue operational problems. Furthermore, it was believed that the high viscosity oil and soda soap together with the greater alkalinity of the AN-G-5 grease should provide increased corrosion protection which would justify any sacrifice of low temperature performance resulting from its use.

To date, the almost complete lack of any Unsatisfactory Reports on the use of AN-G-5a grease in wheel bearings seems to indicate its adequacy as an interim wheel bearing lubricant. After establishing AN-G-5 as a substitute for AN-G-15 greases in wheel bearing applications, the Air Materiel Command initiated a plan for study of the overall problem.

Purpose of Study

A program was envisioned which would include an investigation of some of the many factors affecting the corrosion preventive properties of greases. The desired result of such a program would be the development of a suitable laboratory test or series of tests which would satisfactorily predict the degree of corrosion protection afforded by various greases. It was felt that such a test, when developed, would fill a definite need in Air Force-Navy, aeronautical grease specifications. Prior to this time, corrosion prevention requirements were not included in any of the military aircraft grease specifications for various reasons, but principally because most proposed test methods lacked reproducibility and failed to show any degree of correlation with service data.

Consideration of these facts and the data obtained in previous studies (1) (2) indicated a definite need for a project which would include both laboratory and service tests on a number of various types of greases.

Program of Study

To initiate the program, concurrent studies were carried out in the laboratory and in service aircraft on a group of greases some of which were known to exhibit poor corrosion resistance in service. A description of these greases is presented in Table 1.

TABLE I
DESCRIPTION OF GREASES USED IN LABORATORY AND SERVICE TESTS

Grease "A"—A standard type sodium soap, water soluble grease used commercially in aircraft wheel bearings.
Grease "B"—A mixed sodium-calcium soap grease with added rust inhibitor used commercially in aircraft wheel bearings.
Grease "C"—A Specification AN-G-25 grease of the sebacate diester type.
Grease "D"—A Specification AN-G-15 grease composed of sodium soap with a petroleum oil base.
Grease "E"—Grease "D" with modified emulsifiability characteristics.
Grease "F"—A Specification AN-G-15 grease composed of a mixed sodium-calcium soap and petroleum oil.
Grease "G"—Grease "F" with rust inhibitor.
Grease "H"—A Specification AN-G-5a grease composed of a sodium soap and high viscosity petroleum oil.

Laboratory Tests

After careful consideration of various possible methods for laboratory evaluation of rust-resistant properties of greases, a humidity cabinet test was decided upon for initial investigation.

Two types of cabinets were available for use in this work. One was a modification of the design shown in Specification AN-B-20, and maintained a relative humidity of 95% at a temperature of 100 F. The second cabinet produced continuous condensation on the test specimens under conditions of 100% relative humidity at 120 F. This latter type is described in Specification AN-H-31 (JAN-H-792). As a result of preliminary tests in both types of cabinet, we found that the 100% R.H. cabinet failed to give any appreciable degree of gradation between known good and poor corrosion resistant greases. The 95% R.H. cabinet, on the other hand, seemed to provide the degree of differentiation essential to a satisfactory screening test. For this reason, the static laboratory tests reported in this paper were carried out at 95% R.H. and 100 F.

Previous experiences with low carbon steel panels in humidity cabinet tests having proved unsatisfactory, a different type of test specimen was considered. Inasmuch as rust prevention of grease-coated bearing surfaces constituted the real problem, it was decided to use bearing surfaces for test specimens. However, the large size of the typical aircraft tapered roller bearings obviated their use in any laboratory test. Consequently, a smaller and more readily available 204 K type ball bearing was adopted for use. Later tests using smaller tapered roller bearings showed good correlation with the data obtained using 204 K ball bearings.

In a similar way, a method for packing or coating the test bearing was evolved. New bearings were used in each test. After careful removal from the carton and thorough soaking and cleaning in a petroleum solvent to remove all rust preventive compound, each bearing was rinsed twice in 98% isopropanol to remove the petroleum solvent. The bearing was then dried in an air jet, wiped with a clean rag, inspected and weighed to the nearest 0.1 gram. The bearing was then ready to be packed or coated with the test grease. The bearing was handled with tongs throughout the cleaning and weighing procedure.

In order to simulate actual wheel bearing packing practice in the field, the test bearing was hand-packed using grease pre-coated fingers and hands to force the grease in and around the balls and races of the bearing. The bearing was then hand rotated to insure a uniform distribution of grease throughout the bearing.

Excess grease was then removed until only 1.0 gram remained on the bearing. In order to remove the grease down to this final weight, the bearing had to be

hand rotated to work out the excess from the races. This also served to insure a reasonably uniform grease film over the entire bearing surface.

The bearing, coated with the test grease, was then suspended from a glass hanger and placed in the humidity cabinet maintained at 95% relative humidity and 100 F. for a period of 3 months.

A view of the interior of the humidity cabinet showing the method of suspending the test bearings is shown in Figure 2.

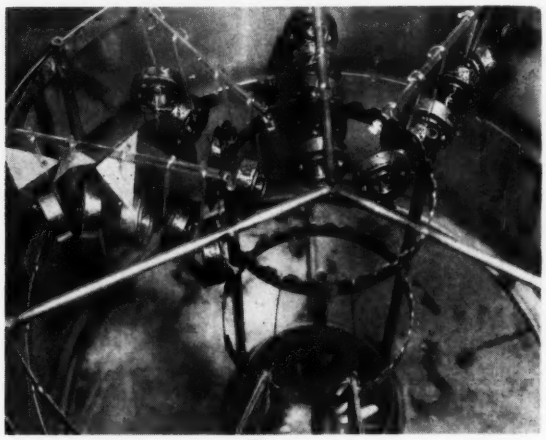


Fig. 2
Interior of humidity cabinet

Daily inspections of the bearings were made initially to record time to incipient corrosion. Weekly inspections were sufficient after the first week to show rust development on continued exposure.

This method of test was found to grade greases with respect to corrosion preventive properties under conditions of elevated temperature and humidity. Examples of no rust, incipient rust, and extreme rust on bearings used in this test are shown in Figure 3. These typical conditions show the degree of gradation obtained in this test between greases exhibiting good and poor corrosion resistance.

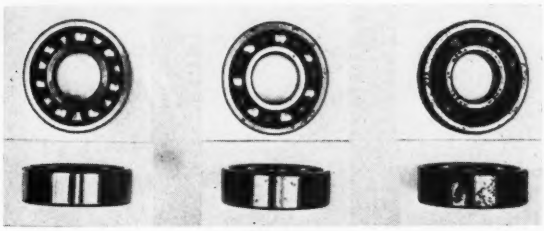


Fig. 3

No Rust	Incipient rust only	Extreme Rusting
Good—1	Borderline—2	Poor—3

Reference standard showing degrees of rusting obtained in 3 months test in humidity cabinet at 95% R. H. and 100 F.

The average results of several series of humidity cabinet tests at 95% R.H. and 100 F. were compiled and the data is presented graphically in Figure 4. In general, we found that greases which ultimately would fail to show adequate corrosion protection in this test usually developed incipient corrosion within one week after being placed in the humidity cabinet. This trend is clearly shown in the graphs for Greases "D," "E," "F" and "G" in Figure 4.

In general, the repeatability of results of the laboratory humidity cabinet test as described was found to be very satisfactory. The data presented above represent

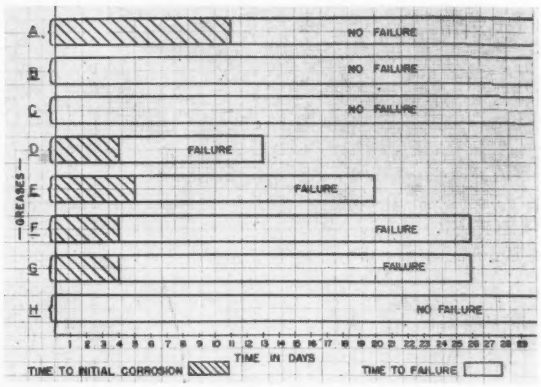


Fig. 4
Average results of humidity tests

the results of several duplicate tests made by the Air Materiel Command on each grease. In almost every case, results of one series of tests were closely duplicated in succeeding tests on the same greases.

In order to determine the inter-laboratory reproducibility of the humidity cabinet test, data obtained by the Materials Laboratory of the Air Materiel Command were checked against the results obtained in the laboratories of some lubricant manufacturers. Grease samples which had been tested and rated previously by the Materials Laboratory were distributed to the other laboratories. The samples represented greases which had shown good, borderline, and poor rust protective properties in the humidity cabinet test. Preliminary results obtained by the various laboratories agreed substantially with those reported by the Air Materiel Command. The degree of correlation obtained is shown in Table 2.

The findings of the Air Force in this work were further substantiated by the Navy in a report issued in April, 1949. (3) The Navy investigation revealed that Specification AN-G-15 greases give less protection against rusting than greases approved under Specifications AN-G-5a and AN-G-25 under very humid conditions.

In view of the encouraging results obtained in the above series of tests, it was decided to enlarge the laboratory static test phase to include many different types of greases.

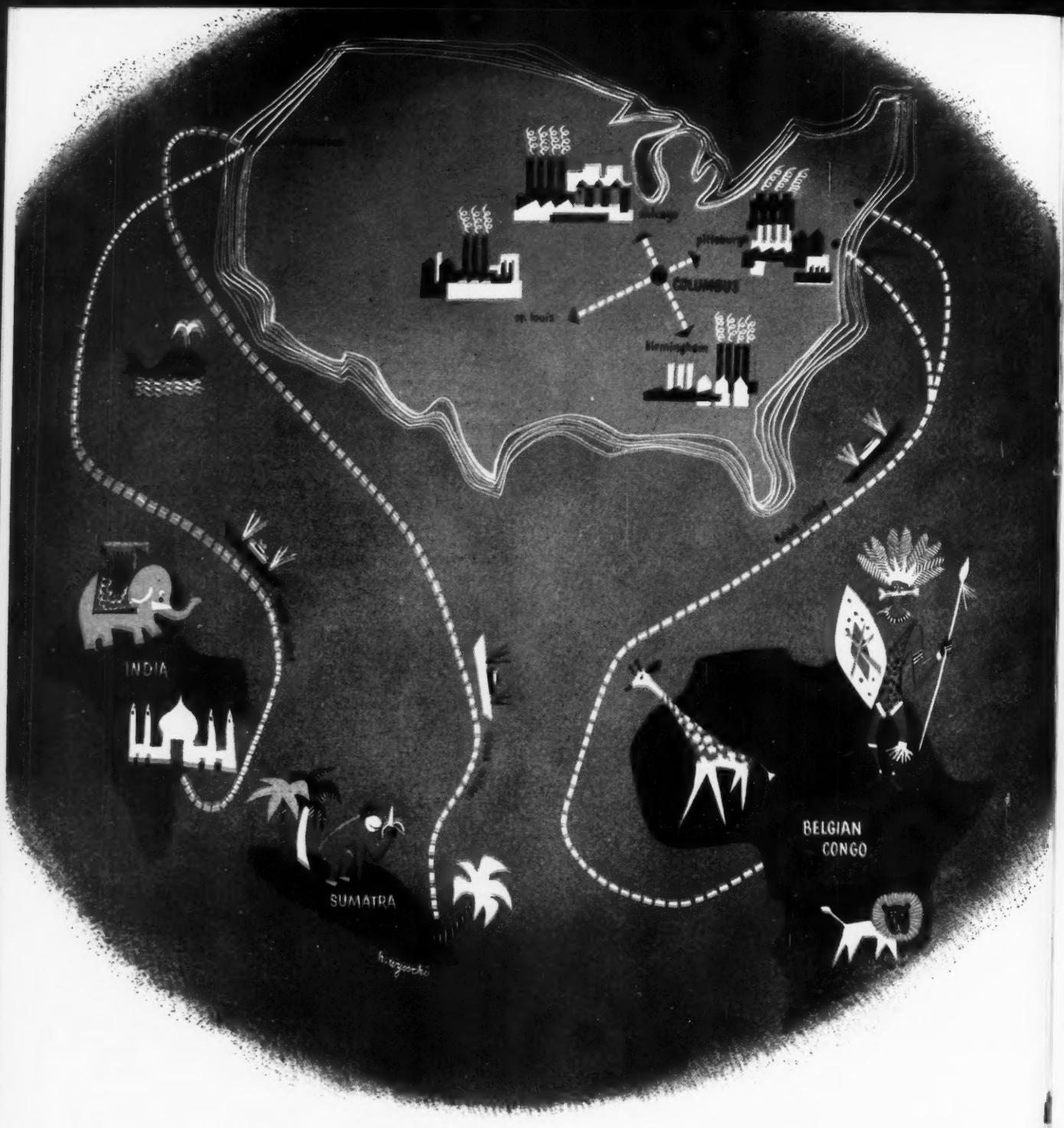
TABLE II

COMPARATIVE RATINGS OF GREASES DETERMINED BY THREE DIFFERENT LABORATORIES IN HUMIDITY CABINET TEST AFTER 3 MONTHS AT 95% RELATIVE HUMIDITY AND 100 F.

Grease Sample	Materials Laboratory AMC	Laboratory A	Laboratory B*
GG	Good No Rust	No Corrosion	No Rust
GB	Borderline Incipient Rust Only	No Corrosion To Incipient Corrosion	No Rust
GP	Poor Extreme Rusting	Development of Rusting with Continued Exposure. Extremely Corroded at End of Test	Moderate Rusting

*This Laboratory conducted tests under slightly different conditions of humidity and temperature.

Field reports had indicated that one grease approved under Specification AN-G-25 had failed to afford adequate corrosion protection in service. A resultant series of tests of all currently approved Specification AN-G-25 greases in the humidity cabinet test showed that this



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same synthetic grease failed to show an adequate degree of corrosion protection as exhibited by the other Specification AN-G-25 greases. (4) The manufacturer of this grease, a polyoxyalkylene glycol diester type, has since made great improvements in formulation and current tests indicate that the latest formulation is acceptable from a corrosion standpoint.

Except for this one outstanding example of poor corrosion resistance in the group of diester greases tested, only minor differences in corrosion resistance were noted in other classes and types of diesters.

A second phenomenon noted in subsequent tests on the glycol diester grease was its apparent susceptibility to fingerprint contamination under the described test conditions. When rubber gloves were used in coating the bearings with this grease no corrosion resulted, although all conditions of test were maintained as before.

In contrast to this result, further study of the finger print effect on the two AN-G-15 greases, Greases "D" and "F," showed that corrosion still developed under high humidity and temperature conditions even when rubber gloves were used in coating the bearings with these greases. These results are shown in Table 3.

A series of silicone greases were tested in the humidity cabinet and were found to exhibit good corrosion protection under the conditions of test. These greases were all of the silicone oil-lithium soap type, each differing only in consistency.

TABLE III

RUBBER GLOVES vs. GREASE-COATED FINGERS COMPARISON OF RESULTS OF TESTS AT 95% RELATIVE HUMIDITY AND 100 F.

Description of Grease	Using Grease-Coated Fingers	Using Rubber Gloves
Grease "D" Specification AN-G-15	Extreme Corrosion	Extreme Corrosion. Little or no improvement over results w/o gloves
Grease "F" Specification AN-G-15	Corrosion—Not as extensive as Grease "D"	Some Corrosion. Slight improvement over results w/o gloves
Glycol Diester Specification AN-G-25	Extreme Corrosion	No Corrosion

To complete current static tests in the laboratory phase of this program, the effectiveness of various oxidation inhibitors as additives in a lithium soap-polyalkylene glycol diester grease was investigated.

The base grease was similar in composition to that which was described earlier as exhibiting poor corrosion resistance in the humidity cabinet test. To each of five samples of this grease was added equal percentages by weight of five different oxidation inhibitors. Results of the test indicate that three of the inhibitors, including phenylalphanaphthylamine and diphenylamine types were effective in imparting adequate rust resistance to the base grease. Di-tertiary butyl paracresol inhibitor slightly improved the corrosion protection of the grease but one anti-oxidant failed to show any appreciable improvement over the original grease.

Results of these tests on various anti-oxidants appear to indicate that the corrosion obtained on some of the bearings may partially be caused by oxidation during the long period of incubation. Another possibility is that some of the materials may have acted as "metal deactivators" and imparted a certain amount of rust protection to the bearing surfaces. Such action, of course, may be applicable only to polyalkylene type greases.

Future laboratory work on the rust preventive properties of greases is planned to include dynamic testing, further investigation of fingerprint suppression, and additional studies of the mechanism of the corrosion protection properties of greases.

Service Tests

The service testing phase of this study was started about two years ago at Wright-Patterson Air Force Base.

Five B-25 aircraft were made available for the test through the Flight Test Division of the Air Materiel Command.

New wheels and wheel bearings were installed on each of the aircraft prior to the test. For the purposes of the test each aircraft was considered to be divided into two parts by an imaginary line through the center of the fuselage. One test grease was placed in both main wheel bearings and one bearing of the nose wheel while a second test grease was placed in the corresponding bearings on the other side of the line. In this way it was hoped to directly compare the various test greases with a Specification AN-G-15 grease under service conditions.

The greases used in the service test were the same as those used originally in the laboratory humidity cabinet test, except for greases "C" and "H" (Reference Table 1). Grease "C" was initially installed on one of the five aircraft but subsequent reassignment of the airplane resulted in loss of test records and withdrawal of this grease from the test.

During the period of test, which lasted approximately one year, the planes performed their normal duties. Periodic inspections of the greases and bearings were made each 50 or 100 hours flying time. Throughout the test, data cards especially designed for the purpose were maintained by the respective crew chiefs on each aircraft. The data obtained included flight destinations, hours flying time, storage time, and average daily weather conditions encountered. These data were supplemented by additional accurate weather information obtained for each locality visited by each aircraft.

Insofar as possible the same cone and roller assemblies were retained throughout the test. In a few instances, however, it was impossible to retain the original bearing cups when the wheels were changed. At the inspection periods, samples of each grease were removed from the bearings and retained for analysis. The bearings were then cleaned, inspected and repacked with more of the same grease.

At the conclusion of the test, all wheel bearings were removed from each aircraft and submitted for technical inspection by the Bearing Unit of the Aircraft Laboratory, Air Materiel Command. As a result of this inspection, two bearings were found unserviceable as a result of moisture corrosion which accumulated on races and rollers. (5) Both of these bearings had been installed on the same aircraft and had been packed with Grease "E", the Specification AN-G-15 type grease which had been modified to reduce its water emulsifiability.

Some corrosion and pitting were noticed on the wheel bearing cups removed from another one of the test aircraft. In this instance the bearings had been packed with greases "F" and "G" which were another type of AN-G-15 grease and its rust-inhibited modification, respectively.

Minor corrosion was noted on parts of four other bearings and in each case the bearings had been origi-

nally packed with either a standard or slightly modified AN-G-15 type grease. On the other hand, the bearings which had contained the commercial type greases showed no evidence of moisture corrosion.

It is interesting to note that the aircraft acquiring the fewest number of hours of flying time in the 12-months period of test showed the most extensive wheel bearing corrosion. Furthermore, the type of corrosion noted on the races and cups of the test bearings closely resembles the corrosion pattern usually associated with bearings which have been immobile for appreciable periods of time.

Reference to Table 4 will show the changes noted in the various greases as a result of use for the number of flying hours indicated.

Free acid content of all greases increased appreciably in use, whether the time interval was as much as 150 hours or as little as 33 hours. This would seem to indicate that oxidation occurs very rapidly in a grease within a short period of use in wheel bearings. However, once the resultant high acid figure is attained, apparently there is very little increase in acid content throughout the remaining normal life of the grease. Although all greases exhibited a marked increase in free acid content in the service test only the Specification AN-G-15 type greases showed a lack of adequate corrosion protection in these tests.

Coincident with the increase in acid content of the test grease there was a marked decrease in penetration and dropping point in all greases with one exception. Grease "B," a commercial type, showed appreciable softening as evidenced by a 23% increase in penetration.

The decreased penetration of all other greases was especially noteworthy, since these data further verify the well-known fact that the AN-G-15 type greases tend to harden appreciably in use. Both Specification AN-G-15 greases showed much greater hardening in use in this service test than either of the two commercial type greases.

As the static test phase of the laboratory project and the service testing phase are concluded, more emphasis can be placed on dynamic laboratory testing. Data thus far obtained tend to indicate that bearing rotation in high humidity conditions may be an important consideration in the development of a suitable laboratory test for determining the corrosion preventive properties of greases.

Summary

In summarizing, the following conclusions may be stated on the basis of data obtained to date:

1. The Specification AN-G-15 greases showed a lack of adequate corrosion protection in both the laboratory and service tests.

2. Th Specification AN-G-15 greases exhibited an apparent structural change in the service tests, which may partially account for lack of corrosion protection usually associated with these greases.

3. There appears to be good general correlation between the results of the laboratory humidity cabinet tests and both prior field experiences and the service test described herein.

4. The current Specification AN-G-25 greases tested in this study, with the exception of the glycol diester type, exhibited adequate corrosion protection properties under conditions of high humidity and temperature.

5. The three different consistencies of silicone type greases tested showed good corrosion protection in the humidity cabinet test.

6. There is a need for further study of the mechanism of rust prevention in greases, but on the basis of present data there are several properties of greases which appear to be useful from the corrosion prevention standpoint. These factors include high alkalinity, a high viscosity or high polarity oil component balanced with the proper degree of water resistance or water emulsifiability, resistance to undue hardening in use, and added inhibition as provided by certain additives.

TABLE IV

RESULTS OF ANALYSIS OF GREASE SAMPLES REMOVED DURING SERVICE TEST

B-25 No. 28873	*Grease "F"*			*Grease "G"*		
	Dropping Point F.	Penetration	Free Acid, %	Dropping Point F.	Penetration	Free Acid, %
Initial Data	309	231	0.21	349	184	0.16
117 Hours Flying Time	244	188	0.40	261	168	0.44
150 Hours Flying Time	285	164	0.43	318	180	0.39
B-25 No. 30046	*Grease "F"*			*Grease "A"*		
Initial Data	309	231	0.21	439	280	0.14
100 Hours Flying Time	280	168	0.47	369	245	0.44
100 Hours Flying Time	284	164	0.36	380	235	0.48
100 Hours Flying Time	273	160	0.36	364	208	0.45
B-25 No. 31171	*Grease "D"*			*Grease "B"*		
Initial Data	344	235	0.18	374	260	0.14
125 Hours Flying Time	337	110	0.54	362	344	0.60
50 Hours Flying Time	344	162	0.55	357	358	0.51
100 Hours Flying Time	343	154	0.35	366	277	0.60
B-25 No. 28711	*Grease "D"*			*Grease "E"*		
Initial Data	344	235	0.18	352	260	0.14
100 Hours Flying Time	335	184	0.38	351	178	0.32
33 Hours Flying Time	341	160	0.35	353	160	0.37

To conclude the service testing phase of this project the weather data obtained for each aircraft was studied and analyzed for the purpose of noting any unusual conditions or circumstances which would be of significance in this work. In general, the differences in temperatures, humidities, and amounts of precipitation encountered by the various aircraft were not of sufficient magnitude to account for the variation in corrosion resistance noted in the test greases.

7. An increase in free acid content of a grease during use is of relatively minor importance in distinguishing between rust-resistant and non-resistant greases.

8. Further studies are required to definitely ascertain the importance of finger-print suppression as it relates to other corrosion preventive properties of greases.

(*Bibliography, see page* 46)

Program Outline, ASLE Annual Meeting

HOTEL STATLER, CLEVELAND—APRIL 7, 8, 9, 1952

Monday, April 7

9:00 A. M.—Registration **11:00 A. M.**—General Society Business Meeting

SESSION 1A—2:15 P. M. (Two Concurrent Opening Technical Sessions)

"Steel Mill Lubrication from Management's Point of View"
By T. R. Moxley, Asst. Gen. Mgr., Steubenville Works, Wheeling Steel Co.

"What Lubrication of Coal Mining Machinery Means to Management"
By C. W. Thompson, Mgr., National Mines Corp., Weirton Mine Operating Office.

"Lubrication in the Chemical Industry"
By T. R. Witt, Lub. Engr., Tennessee Eastman Co., Div. of Eastman Kodak Co.

SESSION 1B—

"New Horizons in Research"
Speaker to be announced.

"A New Plan to Aid Independent Inventors"
By Wm. Mendius, Assistant to the Vice President, Sinclair Research Labs., Inc.

"Lubrication Education"
By J. T. Burwell, Assistant to the Director of Research, Horizons, Inc.

"Lubricant Research in the Department of Defense"
By E. L. Klein, Executive Director, Panel on Lubricants, Committee on Fuels and Lubricants, Research and Development Board, Department of Defense.

Tuesday, April 8

SESSION 2A—9:00 A. M. to 12:00 Noon (Three Concurrent Sessions)

"Forum on Lubrication Economics"
SUBMIT QUESTIONS IN ADVANCE BY WRITING THE CHAIRMAN OR FROM THE FLOOR
Chairman—W. C. Kesler, Crown Cork and Seal Co., Inc.

Discussions—
(1) **"As Related to Oil Reclamation"**—By D. M. Cleaveland, Bendix Prod. Div., Bendix Aviation Corp.
(2) **"As Related to Automatic Lubricating Devices"**—By T. V. Picraux, Lincoln Engineering Co.
(3) **"As Related to Suppliers"**—By C. R. Schmitt, E. F. Houghton & Co.
(4) **"From the User's Viewpoint"**—By R. J. Torrens, Eastman Kodak Co.

SESSION 2B—

"Turbo-Jet and Turbo-Prop Engine Lubrication"
By Lt. L. D. Christensen, Chief, Oil Unit, Petroleum Products Branch, Materials Lab., USAF, Wright Air Development Center.

"Physical and Chemical Properties of Aircraft Lubricating Oils As a Guide to Performance"
By G. G. Lamb, Professor of Chemical Engineering, Northwestern University.

"Oil Fog Lubrication"
By D. G. Faust, Chief Engineer, C. A. Norgren Co.

SESSION 2C—

"Symposium on Bearing Fatigue"
SUBMIT QUESTIONS IN ADVANCE BY WRITING THE CHAIRMAN OR FROM THE FLOOR
Chairman—J. Boyd, Research Labs., Westinghouse Electric Co.

Discussions—
"What Is Bearing Fatigue"—By A. E. Roach and L. G. Johnson, Mechanical Engineering Dept., Research Laboratories Div., General Motors Corp.
"Material Specifications for Oil Film Bearings"—By E. B. Etchels, Design Engineer, Chevrolet Division, General Motors Corp.
"Tired Bearings—Reasons and Remedies"—By J. Palsulich, Assistant Chief Engineer, The Cleveland Graphite Bronze Co.
"The Role of the Lubricant in Bearing Fatigue"—By E. S. Carmichael and R. B. Purdy, Lubricants Section, Socony Vacuum Oil Co., Inc.

SESSION 3A—2:15 P. M. to 5:00 P. M. (Three Concurrent Sessions)

"Cutting Fluids for Machine Tools"
By C. M. Larson, Chief Consulting Engineer, Sinclair Refining Co.

"The Disposal of Waste Oils"
By D. E. Bloodgood, Professor of Sanitary Engineering, Purdue University.

"Prevention and Control of Industrial Wastes"
By P. W. Uhl, Chemist, Detroit Diesel Division, General Motors Corp.

SESSION 3B—

"Hydraulics Forum—Progress Report JIC (Joint Industry Conference) Hydraulic Standards"
SUBMIT QUESTIONS IN ADVANCE BY WRITING THE CHAIRMAN OR FROM THE FLOOR
Chairman—D. P. Morrell, Supervisor, Fluids and Electrical Section, Manufacturing Engineering Office, Ford Motor Co.

Discussions—
"Hydraulic Equipment Manufacturer's Viewpoint"—By J. Robinson, Chief Engineer, Vicker's Inc.
"Machine Tool Builder's Viewpoint"—By K. O. Tech, Chief Engineer, The Cross Co.
"Hydraulic Engineer's Viewpoint"—By A. McHugh, Control Applications Engineer, Lincoln-Mercury Div., Ford Motor Co.

SESSION 3C—

"Fundamental Knowledge of Lubricating Grease Structure"
By B. W. Hotton, Research Chemist, California Research Corp.

"Design Considerations for Optimum Performance of Silicone Greases in Ball Bearings"
By G. Grant, Manager, Motor Test Laboratory, Dow Corning Corp.

"Dispensing Characteristics of Lubricating Greases"
By R. F. Strohecker, Mechanical Engineer, Beacon Laboratories, Texas Co.

Wednesday, April 9

SESSION 4A—9:00 A. M. to 12:00 Noon (Three Concurrent Sessions)

"Symposium on Paper Machinery Lubrication"
Discussions and Speakers to be announced.

SESSION 4B—

"Evaluation of Lubricants for Computing Machines"
By L. J. Hibbert and R. F. McKibben, Finishes Lab., Natl. Cash Register Co.

"Lubricant and Cutting Oil Testing"
By R. J. S. Pigott, Director of Engineering, Gulf Research and Development Co.

"Global Grease Tests"
By Members of the Coordinating Research Council.

SESSION 4C—

"Minimum Oil Requirements for Ball Bearings"
By E. R. Booser and D. F. Wilcock, Bearing and Lubrication Center, General Electric Co.

"Effects of Misalignment on High Speed Journal Bearings"
By G. B. DuBois, Professor of Mechanical Engineering, Cornell University.

"Lubrication and Load Carrying Capacity of Gears"
By E. T. Hutt, Research Engineer, Thornton Research Center, Shell Refining and Marketing Co.

SESSION 5A—2:15 P. M. to 5:00 P. M. (Three Concurrent Sessions)

"Selection and Application of Lubricants"
By C. R. Schlabitzke, Assistant Division Manager, Industrial Sales, McColl-Frontenac Oil Co., Ltd.

"Lubricant Classification"
By C. A. Bailey, Lubrication Engineer, National Tube Co.

"Maintenance of Electric and Gasoline Driven Industrial Trucks"
By A. E. Dorod, Eng. Consult., Baker Industrial Trucks Div., Baker Raulang Co.

SESSION 5B—

"What the Lubrication Engineer Can Do to Reduce Premature Gear Failures"
By S. D. Craine, W. A. Jones Foundry and Machine Co.

"Application of Infra-red Spectroscopy to Lubrication Engineering"
By G. Rappaport, Physicist, Physics Branch, Materials Lab., USAF Wright Air Development Center.

"Seals and Closures"
By E. Fisher, Garlock Packing Co.

SESSION 5C—

"Studies of the Mechanism of Surface Damage by Fretting"
By D. Godfrey and E. E. Bisson, Lubrication and Wear Section, NACA Lewis Flight Propulsion Labs.

"Carbide Steel Milling With Cutting Fluids"
By J. R. Roubik, Research Engineer, Kearney-Trecker Corp.

"The Lubrication Properties of Molybdenum Disulfide"
By I-Ming Feng, Mechanical Engineering Dept., Mass. Institute of Technology.

ASLE Luncheon—Monday, 12.30 P. M. (Speaker to Be Announced)
ASLE Annual Banquet—Tuesday, 7:30 P. M. (Speaker to Be Announced)
Breakfasts for Authors and Chairmen—Tuesday and Wednesday, 7:30 A. M.

LUBRICATION SUMMARIZED

The Part Played by Mechanical Seals in Good Lubrication Practice in Mills and Mines — By C. E. Schmitz, Vice-Pres. & Dir. of Engineering, Crane Packing Co., and President of ASLE.

Submitted by M. C. Miller, Secretary
Pittsburgh Section ASLE

Attention is stressed on the five basic important factors which must be embodied in mechanical seals if they are to give the required service and good life. They are: (1) flexibility; (2) proper finish of the mating faces; (3) positive driving means; (4) proper metallurgy; (5) good engineering plans backed up with laboratory tested and research facilities. The subject matter was directed primarily to mechanical seals and good lubrication practice in rolling mills and mining operations, although it was pointed out that the mechanical seal can be and is frequently used to solve problems in other industries.

The requirement for low RMS and extremely flat surfaces on sealing seat and washers was stressed.

The danger arising from mill scale and water becoming entrained in the lubrication system was pointed out. Further, the problem of contamination of streams and creeks was discussed. Good seal construction can compensate for the complication from axial and radial movement. Mechanical seals on temper pass mills and mills for the rolling of aluminum and other products which can be spoiled by oil droppage were discussed.

The lubrication engineer can show important savings by (1) demanding proper mechanical seals on new equipment; (2) converting existing equipment to their use.

The Nature of the Grinding Process —By M. C. Shaw, Massachusetts Institute of Technology.

Submitted by A. S. McNeilly, Secretary
Boston Section ASLE

The grits of a grinding wheel remove metal by a shear process, just as in the case of any single point cutting operation, such as a lathe or planer tool. The differences between single point cutting and grinding are mainly due to the differences in the size of the chips removed, the speed with which the process is performed and the random geometry of grinding grits. A short film was presented, which showed a cutting operation greatly magnified. Here the shear nature of cutting was evident, and some of the more basic considerations in single point cutting were illustrated. Next, dynamometers for use in measuring the tangential and radial forces on a grinding wheel were illustrated and representative data presented and discussed. The importance of the chip depth of cut was emphasized, particularly with regard to the shear stress involved in grinding, which was found to reach values of the order of two million psi in fine grinding. The significance of the energy per unit volume involved in cutting and grinding operations was discussed and shown to be particularly important with regard to the surface temperatures involved in grinding. It was shown that surface temperatures are paradoxically less when the chip depth of cut is increased, as a result of a corresponding reduction in the energy per unit volume consumed in the process involving the larger chips.

Design, Installation and Operation of Sleeve Bearings—By C. L. Miller, Eastman Kodak Co.

Submitted by W. H. Miller,
Chairman Section News Committee
Buffalo Section ASLE

Mr. Miller reviewed the principles involved in the fluid film theory of lubrication, illustrating with charts and Westinghouse Electric Corp's excellent color movie on the tapered oil film. Summarized, the necessary factors for fluid film lubrication are:

1. Copious lubricant supply along entire length of bearing;
2. Correct geometry and velocity for formation of a fluid film;
3. Unit pressures low enough to allow film to form;
4. Sufficient clearance to allow room for the oil film.

Mr. Miller indicated that the principle of fluid film lubrication is destroyed if oil grooves are placed in or cut through the pressure area of the fluid film. A straight channel, edges well chamfered, parallel to the shaft and just ahead of the pressure area is the most satisfactory grooving method for most installations.

Recent design practice indicates a length-diameter ratio of 1 to 1 or 1½ to 1 is sufficient for most bearings. Abnormally long bearings tend to wear on the outer edges due to shaft deflection. This "bell mouthing" results, finally, in a reduced or shorter effective bearing surface.

Babbitt composition plays an important part in bearing life. Light duty round-the-clock service requires a minimum of 8% tin. As severity of service increases, it is advisable to increase tin content, 80% tin being satisfactory for severe conditions.

Thin babbitt coatings (1/16" for 1" journal, 3/32" for 9" journal) are desired because thick babbitts often result in:

1. Cracks due to thermal expansion differences between babbitt and housing;
2. Poor housing bond;
3. Excessive plastic deformation.

To effect a proper running bearing some of the important items that must be given careful consideration are:

1. Oil viscosity
2. Speed
3. Running position of shaft
4. Clearance
5. Temperature
6. Surface finish
7. Film thickness
8. Bearing area

Many helpful formulae, proved by actual operating experience, are available to evaluate the above factors, many of which are interdependent.

When installing a bearing, qualified personnel should check the following points meticulously:

1. Level bearing housing, journal and bearing
2. Alignment in all directions
3. Proper fit and clearance
4. Thrust collar clearance
5. Seals
6. Clean bearing
7. Venting
8. Level-gage and filler pipe
9. Lubricant—proper type and amount
10. Oil rings turning

Regular inspections of operating bearings should be made with respect to:

1. Proper oil level
2. Correct bearing temperature
3. End leakage
4. Oil rings turning
5. Proper bearing clearance

In determining the cause of a bearing failure, the following items should be investigated as possible causes:

1. Low oil level
2. Leakage through seals

(*Continued on page* 39)

NEWS OF THE SECTIONS

MILWAUKEE

By F. W. Jones, Chairman
Program and Publicity Committee

February 20 — Joint meeting Milwaukee Engineering Society and Milwaukee Section ASLE—Wisconsin Electric Power Company Auditorium.

A capacity dinner crowd of 300 is expected, with 1500 to 2000 present at the meeting.

Mr. W. D. Kyle, Jr., President of the Line Material Co. is expected to make the "coffee talk" at the dinner.

Mr. Blythe R. Jones, Mgr. of the Passenger Car Div. of the Ethyl Corp. of Detroit, is to give a demonstrated talk.

Publicity details include newspapers, radio, TV, publications of other engineering societies and local schools and universities.

This promises to be one of the most outstanding meetings ever held. A cordial invitation is issued to anyone interested in attending. *Contact the Secretary of the Milwaukee Section ASLE.* (SEE SECTION OFFICERS' LIST)

BOSTON

By A. S. McNeilly, Secretary

"The Nature of the Grinding Process," by M. C. Shaw, Massachusetts Institute of Technology.—November 1951 meeting.

(SEE *Lubrication Summarized*)

NEW YORK

"What Management in Industry Expects of the Lubrication Engineer," by C. L. Pope, Eastman Kodak Company.—November 1951 meeting.

Approximately 60 engineering students from 12 major colleges attended this meeting which was designated as "Students' Night," and which was arranged by Professor D. D. Fuller of Columbia University.

The attendance and the response of the students to the excellent talk presented by Mr. Pope evidenced the keen interest which many colleges are taking in the subject of lubrication, and also indicated the need for more comprehensive courses on lubrication at our universities.

The New York Section felt that drawing students from graduate schools into their Section meeting was a most worthwhile educational effort.

BUFFALO AND ONTARIO
(Joint Meeting)

By W. H. Miller, Chairman
Section News Committee
Buffalo Section

"Design, Installation and Operation of Sleeve Bearings," by C. L. Miller, Eastman Kodak Co. — December 1951 meeting.

(SEE *Lubrication Summarized*)

In November the Buffalo Section was honored by a visit from Mr. C. E. Schmitz, National President of ASLE. The extreme importance of lubricants to our very existence was vividly presented by Mr. Schmitz in his novel narration of events which followed the mythical transformation of all lubricants to a concrete-like mass.

Mr. Schmitz reported on the status of the ASLE National Organization. His comments as to finances and growth were most encouraging.

The fact that ASLE is rapidly attaining a position of importance as well as filling a definite need in the lubrication field should be obvious to all who attended the joint Buffalo-Ontario meeting in December. In spite of icy roads and driving snow, the attendance was over the 100 mark, with some traveling 130 miles one way to attend.

KANSAS CITY

By R. R. Matthews, Chairman

The first meeting of the recently organized Kansas City Section was held on Nov. 19, 1951. W. H. Oldacre, President and General Manager of the D. A. Stuart Oil Co. in Chicago, discussed the subject of cutting fluids. Mr. Oldacre is a recognized authority in this field and his presentations are always evocative of much general discussion.

An excellent summarization of his thoughts was presented on page 285 of the December, 1951 issue of this Journal, in the feature *Lubrication Summarized.*

The January meeting of this Section was held at the Linda Hall Library of Kansas City University, which has become one of the leading technical libraries in the Middle West. Mr. Shipman delivered the talk and acted as guide in showing the details of the library set-up. It proved to be a most interesting and informative session.

CHICAGO

November, 1951 meeting—the Railroad Session headed up by Mr. Wayne Lasky, Engineer of Tests, Gulf Mobile & Ohio Railroad, with other railroad personnel present, provided one of the outstanding meetings of this Section to date. Mr. Lasky is a member of numerous technical societies and has delivered many papers on the various phases of railroad lubrication. He lectured last June at the ASLE sponsored summer course in lubrication engineering at M.I.T. He has done a great deal of work on the reclamation of crankcase oils for railroad Diesel locomotives.

Mr. Lasky is Chairman of the Railroad Lubrication Committee under the sponsorship of the Industry Relations Committee of ASLE.

This meeting provided an opportunity for comparison of railroad lubrication problems and lubrication problems met in general industry.

January meeting — "Greasing the Pigskin," by John R. McPhee, Regional Manager of Sales, Ironsides Co.

This was a departure from the regular technical sessions. "Jack" McPhee has a national reputation, officiating as he has, at many intercollegiate football games. He is a graduate of Oberlin College, head of the Eastern Inter-College Officials Association since 1937 and the head of the Western Conference Officials Association since 1942.

As a special feature of this meeting the "Official 1951 World Series Movies" was shown. The Chicago Section are indebted to Mr. McPhee, not only for his visit to Chicago, but for his assistance in obtaining the baseball film for the meeting.

SYRACUSE

By T. F. Dundon, Chairman

"A Salute to the Ladies"—November 1951 meeting.

As a special tribute to the wives of the ASLE members and guests this Section presented one of the outstanding women of achievement in the Syracuse area—Miss Margaret Ingels of Carrier Corporation, Public Relations Department.

Miss Ingels is a graduate Mechanical Engineer of the University of Kentucky. Her business career began with the Chicago Telephone Co. in 1917. After eight years with the U. S. Bureau of Mines Research in Pittsburgh, Miss Ingels began an uninterrupted association with the Carrier Corporation, building a continuing record of achievement. She

(*Continued on page* 40)

"Dag" Colloidal Graphite Resists Heat... Reduces Friction in Hot Metalworking Operations

In deep piercing, casting, forging, stretch-forming and wire drawing operations, **"dag"** colloidal graphite dispersions assure a smooth product and reduce die wear . . . insure smooth surfaces and clean parting . . . minimize scaling and sticking . . . reduce tearing and rippling . . . and assure uniform wire diameters. This unusual lubricant reduces friction and withstands temperatures much in excess of those common to metalworking operations.

"Dag" colloidal graphite is electric furnace graphite that has been specially processed to subdivide it into particles of microscopic size. When **"dag"** colloidal graphite is applied to the friction surfaces of metal it leaves a lubricating film so thin that even the most sensitive gages cannot detect it. The film is many times more durable than an oil film. It provides the metal with a graphoid surface that has an extremely low coefficient of friction, that resists oxidation, and that will function at temperatures far above the burning point of oil.

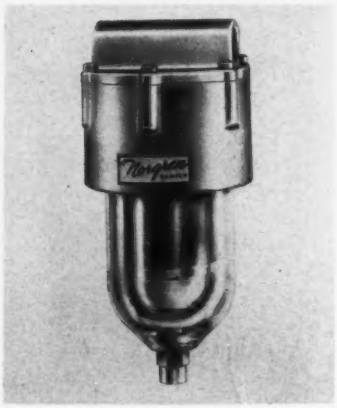
The uses of **"dag"** colloidal graphite for all metalworking operations are explained in a recent bulletin available without obligation. Write today for Bulletin No. 426-12B.

dag DISPERSIONS®

Acheson Colloids Corporation,
Port Huron, Mich.

... also Acheson Colloids Limited, London, England

LUBRICATION IN THE NEWS



FILTER-DRAIN: Designed for use in air lines to portable air tools, air cylinders and air-powered machines where removal of liquids and solids from air lines is required, and where manual draining is not desired or practical.

One of the outstanding improvements claimed over previous filter and drain units is that this new combination filter-drain operates automatically under constant or fluctuating air pressure and air flow. It continues in operation after flow of air is cut off, thereby eliminating any sludge or solid particles in the air before the air goes to the drain chamber.

The new unit is available in ¼″, ⅜″ and ½″ pipe thread sizes for in-line pipe connection installations. Complete data is available from the manufacturer.

C. A. Norgren Co.
Englewood, Colo.

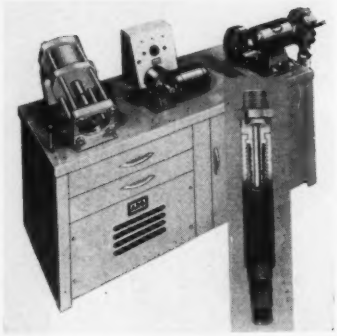
TIN PLATE LUBRICANT: Now on the market, a new lubricant produced entirely from freely available domestic materials, which is said to duplicate all the chemical characteristics of palm oil commonly used in cold rolling steel production.

Trade-named Palmoshield, it has been under continuous testing for the past three years.

The manufacturer claims four distinct advantages in the use of this lubricant over imported palm oil:

1. Wide availability.
2. No necessity for "borrowing" from other defense requirements.
3. Stock piling unnecessary.
4. Lubricant subject to exact chemical control.

Ironsides Company
Columbus, Ohio



HOSE COUPLING MACHINE: The introduction of this machine, said to be the first in the low-priced field, for making permanent hydraulic hose assemblies, should enable users of hydraulic hose, including manufacturing plants and industrial jobbers, to save time, avoid delays and reduce costs by making their own hose assemblies.

The new desk-size machine (floor space 67″ x 29″), is easy to operate and is said to do a complete assembly and swaging job. The manufacturer states that an operator using this machine can produce a finished hose coupled at both ends, in four minutes.

The machine is furnished standard for 115 volts, with 60 cycle, single phase motor. For further information write the manufacturer.

Pyles Industries, Inc., Detroit, Mich.
subsidiary of The Aro Equipment Corp.
Bryan, Ohio

HI-JET SYSTEM: A new twin development—Hi-Jet and Gulf Hi-Jet Oil—is claimed by the manufacturer to increase metal cutting tool life from 300% to 1200%. Small high speed jets of oil are directed not from above but from below the tool. The streams of oil pass through the space between the work and the side relief face of the tool and are aimed at the line of contact between the work and the cutting edge.

The entire unit consists of a jet or a series of jets, flexible tubing, and a small pump capable of providing 400 psi.

Current tooling schedules indicate delivery of the first production units on or about July 1, 1952.

A special oil—Gulf Hi-Jet—has been developed to be used in the new unit. For detailed information write the manufacturer.

Gulf Oil Corp.
Gulf Building, Pittsburgh, Pa.

"LUBRI-CUT": This special cooling and lubricating agent is said to triple production output, at the same time increasing the life of taps, drills and cutting tools.

The patented compound is stated to be fire-resistant, free from abrasives and acids, composed of special cooling and lubricating agents that cling to the tool, and to give excellent results in high speed drilling, tapping, countersinking and swedging. For free samples and complete information write the manufacturer.

Tap & Drill E-Z Corp.
11033 Hawthorne Blvd., Inglewood, Calif.

DIESEL LINER: Lube-Lok, a bonded to metal lubrication process, is now being successfully applied to Diesel liners for two Class I railroads, according to the manufacturer.

The Electrofilm process is currently being used by major aircraft manufacturers, oil tool companies, plus the armed services and the Atomic Energy Commission.

Nation-wide processing plants have been established in the following cities: Newark, Detroit, Dayton, Chicago, St. Louis, Minneapolis, Colorado Springs, San Diego, Seattle and Los Angeles.

Electrofilm Corp., 7116 Laurel Canyon Blvd.
North Hollywood, Calif.

CYANAMID BOOKLET: For manufacturers of lubricating greases, the three new grades of Cyanamid Aluminum Stearates, G-100, G-200 and G-300 are described. The three grades have similar physical and chemical properties but differ sharply in gelling strength. For further information write the manufacturer.

American Cyanamid Company
30 Rockefeller Plaza, New York 20, N. Y.

(*Continued on page* 46)

CURRENT LITERATURE

Chemical Processing, Vol. 14, No. 10, October, 1951.

SERIOUS FIRES CAN BE PREVENTED BY USING NON-FLAMMABLE HYDRAULIC FLUIDS

Anon.—p. 29

"Ucon" brand hydrolubes are products of Carbide and Carbon Chemicals Company. They consist mainly of water, and various glycols, together with other ingredients to protect against corrosion and to provide anti-wear properties, good lubricity, metal deactivation and additive solubility over a wide temperature range.

Diesel Power, Vol. 29, No. 10, October, 1951.

TROUBLE SHOOTING

Anon.—pp. 72-74, 94

Five of the main checks to be made when loss of lubricating oil becomes excessive are: stuck rings, leaking connections, no shield, worn link, worn oil seals. Dilution of lubricating oil may occur when any of the following conditions are present: stuck rings, leaking connections, dirty breather, cracked injector, excessive fuel.

Diesel Power & Diesel Transportation, Vol. 29, No. 11, November, 1951.

NAVY DEVELOPS ELECTRIC MOTOR GREASE TESTER

Grupp, G. W.—p. 49

A new electric motor grease tester, designed and built by U.S. Naval Engineering Experiment Station at Annapolis, Maryland, is being used to test greases at high temperature. This apparatus, which can even test large bearings operated at slow speeds under heavy loads, consists of thirty individual test units mounted on two test stands with all controls and recording instruments centralized on a control panel. The instrumentation for each unit is complete.

Journal of Chemical Education, Vol. 28, No. 11, November, 1951.

STOPCOCK LUBRICANTS

Brooke, M.—pp. 602-603

Most laboratories prefer to buy prepared stopcock lubricants but the occasion sometimes arises for a special lubricant that must be particularly developed. Because of low vapor pressure and insolubility in aqueous reagents, the petrolatum-rubber paraffin lubricants are among the most popular. A bibliography is given covering recipes for various types of lubricants for this purpose. In searching for hydrocarbon insoluble lubricants some workers investigated sugar gels. Starch may be suspended in glycerol. This forms a heavy grease resistant to ethyl and petroleum ethers. It seems that resins might make desirable stopcock lubricants but little has been reported on their use. Most of the lubricants described were organic, but a few are inorganic.

Journal of Commerce, New York, Vol. 230, No. 17,517, November 8, 1951

POWDER LUBRICANT

Anon.—p. 4

A powder lubricant called "Grafize" is available for industrial and shop use according to Betterby Inc., 230 Fifth Ave., New York. This lubricant works like graphite, but eliminates the black smears associated with graphite. It is not an oil, and will not melt, freeze or soil. It is applied with a refillable rubber applicator, and can be blown dry into any moving part. In addition, it may be applied by mixing with lubricating oils or greases. Composition is not given.

Journal of the Institute of Petroleum, Vol. 37, No. 333, September, 1951

SUITABLE HYDROCARBON FOR OIL-WATER DISPERSION MEASUREMENTS
Mills, O. S.—p. 465A

(Nature, Vol. 167, p. 726, 1951)

3-3-Ditolyl has been used with good results as an oil phase. Some of its physical properties are given.

THE PROBLEM OF LUBRICATION

Kachlik, K.—p. 468A
(Nafta, Vol. 6, pp. 59-63, March 1950, Vol. 6, pp. 91-96, April)

Author discusses briefly the requirements of first-class lubricants in specific gravity, pour points, flow points, viscosity, viscosity index, etc.

Mechanical Engineering, Vol. 73, No. 11, November, 1951

BEARINGS, LUBRICANTS, AND LUBRICATION: A DIGEST OF 1950 LITERATURE

Geniesse, J. C. and Special Research Committee on Lubrication—pp. 892-896

The following topics are discussed: journal bearings and bearing materials, ball and roller bearings, thrust bearings, automotive lubricants, metalworking lubrication, boundary lubrication, additives for boundary lubrication, thickness of boundary films, foaming, lubricating greases, aircraft hydraulic fluids, synthetics, load-carrying capacity, and fluorocarbons. (72 references).

LUBRICATION: ITS PRINCIPLES AND PRACTICE

Michell, A. G. M.—p. 941
(Blakie and Sons, Ltd., Glasgow, Scotland, 317 pp., 1950).

Considerable space is devoted to physical properties of lubricants and their flow through spaces such as capillaries and between flat plates, and to the viscometry of lubricants. Then the chapters take up in turn: sliding bearings; thrust bearings and some other plane sliding bearings; journal bearings; rolling bearings; lubrication of gears, piston rings and pivots; distribution and treatment of lubricants in service; and conveyance of lubricants in systems of distribution and circulation.

National Petroleum News, Vol. 43, No. 47, November 21, 1951

ANTIRUST PAINT
Anon.—p. 60

STAINLESS STEEL COATING
Anon.—p. 61

A new paint is said to be an anti-rust coating which can be applied over rust without wire brushing, scraping or sand blasting. The paint is said to be suitable for interior or exterior use on old or new metal and is available in black, aluminum and clear. It penetrates through existent rust layer and seals the surface against further rust action, according to the company. A stainless steel coating which can be applied with brush or spray gun is said to protect metal surfaces against rust, corrosion and general deterioration. The film is non-flammable when dry. The first manufactured product is put out by the Monroe Co. and the second by the Steelcote Manufacturing Co.

Oil Daily, Vol. 1, No. 21, October 31, 1951

CONSOLIDATED SPECIFICATIONS SEEN AID TO LUBE SUPPLY

Anon.—p. 8

The consolidation of lubrication specifications now being worked out by the armed forces and industry will greatly simplify supply problems, W. Kelley, of the Munitions Board's office of petroleum programs, said yesterday at the meeting of the National Lubricating Grease Institute.

Oil, Paint and Drug Reporter, Vol. 160, No. 22, November 26, 1951

HYDRAULIC FLUID DATA ISSUED

Anon.—p. 47

A twenty-page booklet which describes in detail the general properties of "Skydrol," a synthetic non-flammable type hydraulic fluid, and includes latest data on its evaluation in the laboratory and performance in aircraft installations, has been issued by Monsanto Chemical Company, St. Louis, Mo.

Oildom, Vol. 29, No. 20, November 30, 1951

LUBE ADDITIVES SUPPLY ASSURED

Anon.—p. 1104

Cooperation by the National Production Authority, the Petroleum Administration for Defense, and various manufacturing companies has averted a threatened shortage of additives for lubricating oil, according to Bruce K. Brown, deputy administrator of PAD. There will be adequate supplies of the important additives to meet all essential requirements. PAD undertook beginning April 6, 1951, a survey of additives manufacturers to determine the quantity and type of additives used for internal combustion lubricating oils, industrial oils, and gear oils. The survey did not cover grease or grease-like lubricants, or synthetic oils. Answers to the questionnaires indicated a prob-

(*Continued on page* 41)

OILS AND LUBRICANTS
PATENT ABSTRACTS

Printed copies of patents are available from the Patent Office at twenty-five cents each. Address the Commissioner of Patents, Washington, D. C., for copies and for general information concerning patents.

From Official Gazette—Vol. 652, Nos. 1, 2, 3, 4; Vol. 653, Nos. 1, 2, 3, 4.

PREPARED *by* ANN BURCHICK

Rust-Inhibiting Compositions — Patent #2,574,954—John W. Bishop, assignor to Tide Water Associated Oil Co.

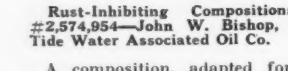
A composition, adapted for inhibiting rusting of metal surfaces, comprising a hydrocarbon vehicle in major amount based upon the weight of said composition having dissolved therein as a rust-inhibiting component from about 0.01 to about 20% by weight of a loosely bound addition product of acid lauryl phosphate and a tertiary ethanol amine esterified with a fatty acid from the group consisting of stearic acid and oleic acid, said esterified amine being present in a ratio of one mole of amine to about one to one and a half moles of the acid phosphate.

Lubricating Composition — Patent #2,574,994—David E. Adelson, assignor to Shell Development Co.

A lubricant comprising a major amount of lubricating oil and a minor amount, sufficient to stabilize said oil against oxidation and corrosion deterioration, of a reaction product obtained by reacting an unsaturated cyclic ketone fraction having at least 12 carbon atoms with hydrogen sulfide and ammonium hydrosulfide, at between about room temperature and about 100 C. and treating the resulting reaction product with a phosphorus halide at between about steam temperature and 200 C. in the mol ratio of around 1 to 4 respectively.

Lubricating Grease Composition—Patent #2,575,286—Arnold J. Morway and Paul V. Smith, Jr., assignors to Standard Oil Development Co.

A lubricating grease composition consisting essentially of a lubricating oil thickened to a grease consistency with from 5 to 20% by weight of a mixture of an alkali metal soap of a high molecular weight fatty acid and an alkali metal salt of a low molecular weight oxy acid having the general formula:



wherein R′ and R″ are saturated aliphatic radicals and R′ plus R″ contain a total of at least 2 and not more than 7 carbon atoms.

Fiber Lubricant Composition — Patent #2,575,382—Marshall Duke and Conrad Hohing, Jr., and Boyd L. Shaffer, assignors to Celanese Corp. of America.

A lubricating and conditioning composition consisting essentially of a mixture of 5 to 15 parts by weight of the primary ester of phosphoric acid with n-decanol, 10 to 30 parts by weight of the diethanolamine-ethyl ester of lauric acid, 1.5 to 4.0 parts by weight of the diethly-cyclohexylamine and 1.5 to 4.0 parts by weight of diamyl phenol blended into 50 to 70 parts by weight of mineral oil.

Textile Lubricant—Patent #2,575,399—George W. Seymour and Marshall Duke, assignors to Celanese Corp. of America.

A lubricating and conditioning composition consisting essentially of a mixture of 5 to 15 parts by weight of the primary ester of phosphoric acid with n-decanol, 10 to 30 parts by weight of the diethanolamino-ethyl ester of lauric acid, 1 to 4 parts by weight of triethanolamine and 1 to 4 parts by weight of diamyl phenol blended into 50 to 70 parts by weight of mineral oil.

Production of Oil-in-Oil Emulsions — Patent #2,575,874 — Anders Herlow, assignor to A/S Grindstedvaerket.

The method of producing an emulsion of the type oil-in-oil in which an oil intended to form the interior oil phase is divided into separate particles by emulsification in an aqueous phase in the presence of an emulsifying agent to produce an oil-in-water emulsion and the oil-in-water emulsion thus produced is introduced into a continuous oil phase having a lower melting point than the oil in the interior phase.

Thickened Oils and Greases — Patent #2,576,837—Carl F. Irwin, assignor to E. I. du Pont de Nemours & Co.

A composition which is a substantially completely fluorinated hydrocarbon oil distilling at temperatures in the range of from about 50 C. to about 300 C. at 10 mm. Hg pressure having incorporated therein an interpolymer of tetrafluoroethylene and chlorotrifluoroethylene in which the tetrafluoroethylene is in the proportion of from about 98.5% to about 20% by weight, the interpolymer being in the form of stringy fibrous masses and constituting from about 0.5% to about 20% by weight of the composition; such composition being stable and homogeneous in appearance, having a consistency in the range of thickened oils and greases at atmospheric temperatures, and being capable of being heated to temperatures between 175 C. and 400 C. where it forms a clear liquid and then cooled to atmospheric temperatures and to its original condition.

Emulsions — Patent #2,577,218 — Mathijs van der Waarden, assignor to Shell Development Co.

An oil concentrate capable of forming a stable, non-gelling water-in-oil emulsion, said oil concentrate comprising an oil containing from 0.5% to about 15% of free degras fatty acid fraction of degras and from 0.02% to 5% of an organic compound selected from the group consisting of colophony, the acidic fractions of said colophony and mixtures thereof.

Sulfurization of Lard Oil—Patent #2,577,636—Elmer H. Sperry, assignor to Sun Cil Company.

A process of sulfurizing lard oil which comprises contacting hydrogen sulfide and sulfur dioxide in the presence of said lard oil at a temperature of from 50 F. to 100 F.

High Melting — High Water-Resistant Grease—Patent #2,577,706—Bruce W. Hotten, assignor to California Research Corp.

An improved lubricant comprising a major proportion of a grease stock consisting essentially of a lubricating oil and an organic acid alkali metal salt grease thickening agent, and a small amount, sufficient to improve the resistance of said grease stock to emulsification in water, of a polymeric compound containing recurring saponifiable groups selected from the class consisting of carboxyl and carboxy-ester groups, of which from 10% to 60% are saponified by metals selected from the group consisting of alkali metals and alkaline earth metals.

Lubricating Compositions containing Dicarboalkoxy-Diheptadecyl Selenides — Patent #2,577,719—Wm. T. Stewart, assignor to California Research Corp.

A lubricant comprising a major proportion of a hydrocarbon oil and 0.1 to 2% by weight based on finished oil of 1,1′-dicarboalkoxy heptadecyl selenide additive selected from the group consisting of 1,1′-dicarboalkoxy-8,8′-heptadecyl selenide; 1,1′-dicarboalkoxy-9,9′-heptadecyl selenide; and mixtures thereof, wherein the alkoxy groups have not more than 8 carbon atoms.

Hydrodesulfurization of Sulfur—Containing Hydrocarbon Fractions—Patent #2,577,823—Harrison M. Stine, assignor to The Standard Oil Co.

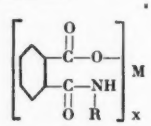
A process of desulfurizing heavy hydrocarbon oil fractions containing between 1.0 to 6.5% by weight sulfur in the form of organic sulfur compounds, which comprises subjecting said oil in the presence of added hydrogen in partial pressure of 100 to 500 pounds per square inch gauge at a temperature in the range of 650 F. to 850 F., to the action of a contact mass consisting of chromium, molybdenum and aluminum oxides in proportions to provide 50 to 85 mol per cent of aluminum oxide and the remainder molybdenum oxide and chromium oxide, each in an amount of not less than 2 mol per cent and not more than 30 mol per cent, and in which the molybdenum oxide is precipitated on preformed aluminum oxide at a pH of 6 to 8.

Lubricant Containing a Reaction Product of Water-Soluble Sulfonic Acids and Phosphorus Sulfide—Patent #2,578,689, Michael W. Freeman.

A lubricating composition having incorporated therein a minor amount, sufficient to impart extreme presure and corrosion inhibiting properties of a reaction product obtained by treating a water-soluble petroleum sulfonic acid as the only essential sulfonic acid present with from 10% to 40% of phosphorus sulfide, based on the weight of water-soluble petroleum sulfonic acid, at an elevated temperature not exceeding 450 F. until cessation of formation of hydrogen sulfide.

Lubricating Greases—Patent #2,578,851—Herschel G. Smith, Troy L. Cantrell, and Mark L. Hill, assignors to Gulf Oil Corp.

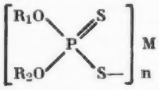
A lubricating grease which comprises a major amount of a soap-oil grease, and a minor amount, sufficient to prevent bleeding, of a metal phthalyl alkyl amide having the formula:



wherein R is an alkyl group containing from 8 to 20 carbon atoms, X is a whole number equal to the valence of M, and M is a metal.

Lubricating Composition—Patent #2,579,037—Elliott A. Evans and John S. Elliott, assignors to C. C. Wakefield & Co., Ltd.

A lubricating composition comprising as a major ingredient a mineral oil base, said base having incorporated therein as an additive a small amount sufficient to inhibit bearing corrosion and oxidation of said oil and to substantially reduce the deposition of gum, lacquer and carbon, of an oil-soluble salt of an organic dithiophosphoric acid represented by the general formula:



wherein n represents the valency of the metal M, R_1 is a saturated radical free from aromatic substitutents and containing an ether grouping and is selected from the group consisting of aliphatic radicals and heterocyclic radicals containing only carbon and oxygen in the nucleus and R_2 is an organic radical having at least 5 carbon atoms and embodying a radical selected from the group consisting of saturated aliphatic radicals, saturated alicyclic radicals and saturated heterocyclic radicals containing only carbon and oxygen in the nucleus.

Lubricant Composition—Patent #2,579,038—Elliott A. Evans and John S. Elliott, assignors to C. C. Wakefield & Co., Ltd.

A lubricating composition, which comprises, a hydrocarbon lubricating oil base in major proportion between 0.05% and 2.0% by weight of said base, a proportion between 0.05% and 2.0% by weight of said base of a tin salt of an oil-soluble petroleum sulphonic acid and a proportion between 0.1% and 2.0% by weight of said base of an oil-soluble chromium salt of an octyl cresyl dithiophosphoric acid.

(*Continued on page* 43)

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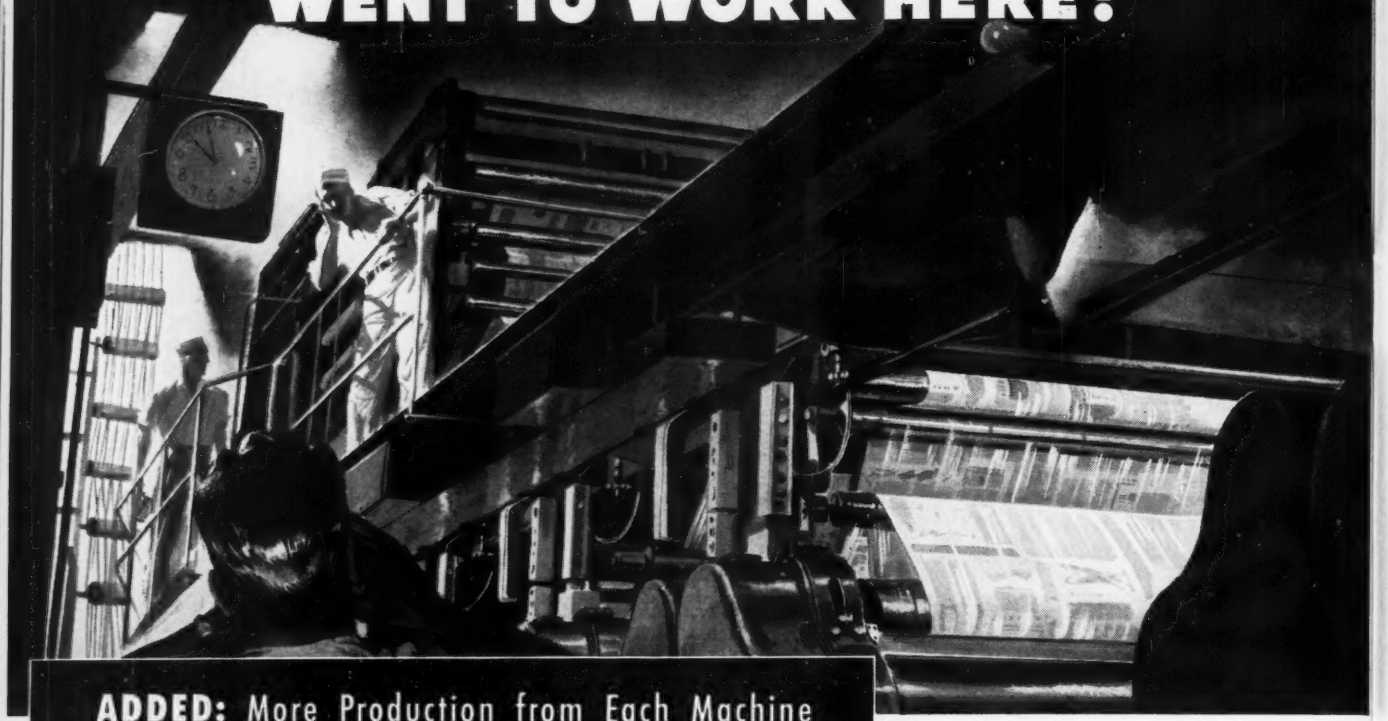

ADDED: More Production from Each Machine

REDUCED: Stock Spoilage and Down-Time

SAVED: A Total of $4,247 Every Year

Friction was once a daily menace—and a costly one—in this Chicago plant.* Protected only by old-fashioned methods of lubrication, this company's mammoth high-speed presses were breaking down with alarming frequency. Stock spoilage was high. Oil consumption ran to $5,664 a year.

Then, a trained Alemite "Friction-Fighting" specialist was called in to work with the plant engineers. After a month's test on one press an Alemite Mechanized Lubrication System was installed on all five machines in the plant at a total cost of only $2,471.

Since that time, there has not been a single breakdown or bearing loss, stock spoilage and down-time have been greatly reduced, and lubricant cost has been cut to $1,417! This is an annual saving of $4,247, *in addition* to more production gained from each press, and a marked improvement in quality for increased customer satisfaction!

No matter what size or type of plant you operate, an Alemite Lubrication Engineer can show you dozens of ways of making worthwhile savings through more efficient handling of petroleum products. These are facts which you can readily confirm in your own time studies. The Alemite man will cooperate fully with your plant engineers in setting up a test. Contact your local Alemite Industrial Distributor, or mail coupon below—today! *Name on Request.

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☐ Include Facts on OIL-MIST—the amazing new system that atomizes oil, circulates it to bearings under pressure.

ALEMITE, Dept. P22
1850 Diversey Parkway, Chicago 14, Ill.

Name.....

Company.....

City..... State.....

Lubrication Summarized

(*Continued from page* 29)

3. Inoperative oil rings
4. Low tin content babbitt for the type service
5. Shims made of compressible material
6. Insufficient thrust collar lubrication
7. Too high thrust for plain thrust collar
8. Improper venting
9. Misalignment
10. Bearing in one pressure area and filler pipe in another (false oil level reading likely on fan installations).

Oil Mist Lubrication — By H. S. Whitcomb, Alemite Company.

Submitted by D. W. Moore, Chairman Section News Committee Cincinnati Section ASLE

There are two basic requirements in the design of a lubricator. These are: 1. Something to hold the oil. 2. Some manner of getting it to the point of application, i.e., squirting. These basic ideas have been developed and refined to bring about the present day lubricators. To be specific, oil mist lubrication is a continuous and controlled means of automatically maintaining minute drops of oil on a bearing surface.

The claimed advantages of oil mist are numerous, some of them being: 1. Saves down time. 2. Decreases maintenance costs. 3. Continuous lubrication. 4. Automatic control. 5. Eliminates guess work. 6. Prevents contamination. 7. Reduces bearing temperature. 8. Eliminates friction. 9. Protection at high speeds. 10. Longer bearing life. 11. Reduces oil consumption.

Oil Mist Lubrication takes into consideration the following items:

1. Air Supply
2. Water Trap
3. Air Valve
4. Lubricator
5. Piping
6. Fittings

The air used for oil mist may be supplied from plant air. Ten pounds of air is more than sufficient pressure. If desired, a special pump may be used which will only supply lubricators.

A water trap is always used in conjunction with an oil mist lubricator and is supplied with each unit. This is one reason why it is possible to use plant air. An automatic unloader can be installed along with the trap in order to make this unit self operating and foolproof.

The air valve is the starting mechanism for the lubricator. This can be hand operated or by using a solenoid valve can be tied into the switch of the machine being lubricated.

The lubricator consists of the following components:

1. Air regulating valve
2. Oil regulating valve
3. Filler plug
4. Sight window for oil level
5. Mist outlet with baffle to eliminate heavy ends

The light ends passing from the lubricator are non-condensing or air floating and range in size from 10 to 20 microns. Air at two to four pounds is the transporting medium. It might be stated here that on an average installation 1 to 2 oz. of oil is used per lubricator per hour. Because of this saving, it is possible to go to a more expensive oil with higher quality.

The piping and fittings supplied with the unit are quite important to proper operation of the unit. It has been found by experience that thirty feet of ½" tubing may be run without precipitation and in addition several ¼" lines may be taken off of this ½" main header. These ¼" lines may be ten feet long.

The secret of perfect mist lubrication to all points is to keep the system pressurized or in balance. This is accomplished by means of special nozzles at the end of each line at the point to be lubricated. The nozzle has a second purpose which is to precipitate the oil mist, this being done by the increase in velocity of the mist in going through the nozzle. An interesting point is that different types of nozzles are used for different applications. These are listed below:

1. Anti Friction bearings
2. Gears and cams
3. Plain bearings or cams
4. Special condensing nozzle to form drops

A fairly good rule to guide design is as follows: One mist unit will lubricate a total of thirty inches on diameters of shafts using anti friction bearings. Twenty inches on summation of diameters is allowable on journal bearings. The length of the bearing is of no importance. If the machine has a larger requirement, more than one mist unit should be used.

OPPORTUNITY AVAILABLE

Technical writer under 35, preferably mechanical or chemical engineer. Able to collect, organize and write technical copy. Industrial experience, particularly in modern lubrication particulars, desirable but not essential. Excellent working conditions and employee benefits. Permanent.

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PLANT REPORT

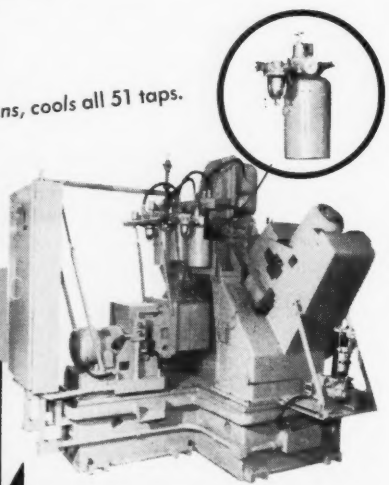
16,320 holes tapped per 8-hour shift with one machine...every one lubricated with Norgren Oil Fog. 51 taps per chucking.

INSTALLATION:
New type tapping machine built by the Snyder Tool and Engineering Co., Detroit, for use by one of the "big 3" automobile manufacturers. The machine taps 51 holes in an engine block at one chucking; taps 40 blocks an hour; replaces 4 machines in the production line.

PROBLEM:
To obtain uniform lubrication and cooling of all 51 taps and eliminate the use of a messy coolant system.

SOLUTION:
Use of a Norgren Oil Fog Lubrication System consisting of air filters, air pressure regulators, Oil-Fog Lubricators and aerosol distributors. Solenoid valves control intervals of oil-fog distribution to the taps.

RESULTS:
BETTER TAP HOLES...
...oiled air *lubricates, cleans,* cools all 51 taps.
LESS TAP BREAKAGE
LONGER TAP LIFE
NO MESSY COOLANT SYSTEM



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25 YEARS OF HELPING TO MAKE AIR POWER SERVE INDUSTRY BETTER

NEWS OF THE SECTIONS

(*Continued from page* 30)

is a member of the Board of Governors of the Technology Club of Syracuse and has authored many diversified technical articles pertaining to engineering.

An unusual announcement of this special Section event was sent out and an excellent response was received. After the meeting a buffet luncheon was served and a presentation of nylon hose was made to each woman guest.

SAGINAW VALLEY

By D. H. Buell, Secretary

"Hydraulics in Industry," by E. O. Clark, Mgr. of Industrial Products Sales, Vickers, Inc.—November 1951 meeting.

Mr. Clark's talk was extremely well received and provided an enlightening evening for this group.

Ed. Note: Detailed information has been published on the subject of hydraulics through the columns of this JOURNAL. We are therefore not presenting an abstract of Mr. Clark's lecture.

CINCINNATI

By D. W. Moore, Chairman
Section News Committee

"Oil Mist Lubrication," by H. S. Whitcomb, Alemite Company—November 1951 meeting.

(SEE *Lubrication Summarized*)

By C. A. Garrison, Secretary

December 1951 meeting — "Stump the Experts"—This is always a successful program when presented before a Section meeting. The Panel to which the questions were directed was composed of Dr. M. E. Merchant, Assistant Director of Research, Cincinnati Milling Machine Company; Mr. Wm. Schuck, Chief Lubrication Engineer, Armco Steel Corporation; Mr. Robert McKibben, Chief Engineer, National Cash Register Company; Mr. John Bunnell, Vice President, Oil-Kraft, Inc.; and Mr. Ray Lewis, Lubrication Engineer, The Texas Company.

The judges were R. S. Shoemaker, Brooks Oil Company and W. C. Hammer, Sharvania Oil Company.

To some degree the success of the program was measured by the fact that no one received the $1.00 Award for asking a question that could not be answered.

A slide film entitled "Gulfpride H. D.," was shown by J. C. Ashcraft, Gulf Refining Company, as a portion of the evening session.

YOUNGSTOWN

By J. P. Halwachs, Secretary

"Standardization in the Lubrication Department," by J. D. Lykins, Chief Lubrication Engineer, Wheeling Steel Corp.—November 1951 meeting.

Mr. Lykins illustrated his discussion with slides to point up the fact that reviewing a plant's entire lubrication program results in the final utilization of a minimum of lubricants.

Methods of selection, and approval of specific lubricants for varying operations were discussed, as well as standardization of lubricating devices, replacements and repairs which are handled at a central depot. This results in a simplification of the training program, saves storage space and eases the problems of purchase and inventory.

(*Continued on page* 47)

CURRENT LITERATURE

(*Continued from page* 33)

able rapid expansion in the use of detergents, principally because of an expected increased use of the chemicals in ordinary automotive lubricating oils.

No. 33, November 19, 1951

NEW SYNTHETIC LUBRICATING OIL DEVELOPED FOR TURBINE ENGINES
Anon.—p. 2

The new oil can be used in both turbo-jet and turbo-prop engines. The base of the new lubricant is one of a class of chemicals known as aliphatic diesters. To this base is added phenothiazine and tricresyl phosphate. Cooperating with the military in the development of the new products were the following oil and chemical companies: Standard Oil Development Co., the Texas Co., Shell Development Co., California Research Corp., Rohm and Haas, Emery Industries, du Pont's organic chemicals department, Ohio-Apex, Hardesby Chemical Co., and Carbide and Carbon Chemicals Corp.

Petroleum Refiner, Vol. 30, No. 11, November, 1951

WASTE OIL CLEANING SYSTEM DEVISED
Anon.—p. 129

Removing foreign matter from waste oil transferred from a slop tank or skimmer pit may be accompanied by screens wiped by revolving brushes. A photograph showing the apparatus is given. Conventional fiber brushes are used.

Petroleum Times, Vol. 55, No. 1414, October 19, 1951

USES OF FULLER'S EARTH
Anon.—p. 951

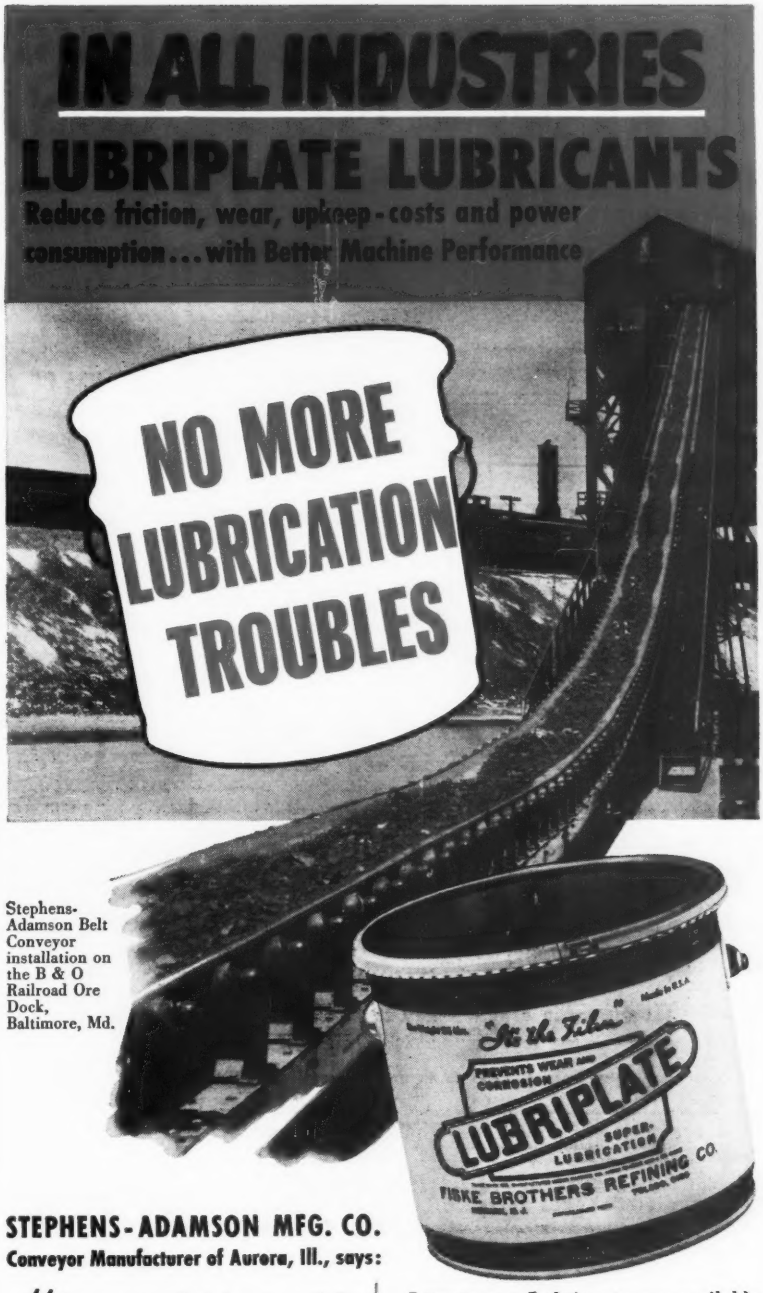
Four leaflets on the use of earths have been issued by the Fuller's Earth Union Ltd., of Redhill, Surrey. The titles are as follows: "The Properties of Fuller's Earth," "Notes on Activated Fuller's Earth for Mineral Oils and Waxes," "Notes on Activated Fuller's Earth for Regenerating Used Mineral Oils," and "Fullbent."

Platt's Oilgram, Vol. 29, No. 226, November 16, 1951

MILITARY REVEALS NEW SYNTHETIC LUBRICATING OIL
Anon.—p. 1

Defense Department has revealed development of "the first joint military specification for a synthetic lubricating oil for turbine aircraft engines" MIL-L-7808. New oil, military said, is applicable for both turbo-jet and turbo-prop engines and will withstand operating temperature from minus 65 to plus 500 deg. F. At lower temperature, it is reported to be one-third as viscous as "the best petroleum-base product" and at higher temperatures is only one-twentieth as volatile as petroleum-base products "and therefore will not boil off." Base of new lubricant is one of class of aliphatic diesters to which is added phenothiazine (to prevent oxidation at high temperatures) and tricresyl phosphate (to prevent gear wear).

(*Continued on page* 45)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STEPHENS-ADAMSON MFG. CO.
Conveyor Manufacturer of Aurora, Ill., says:

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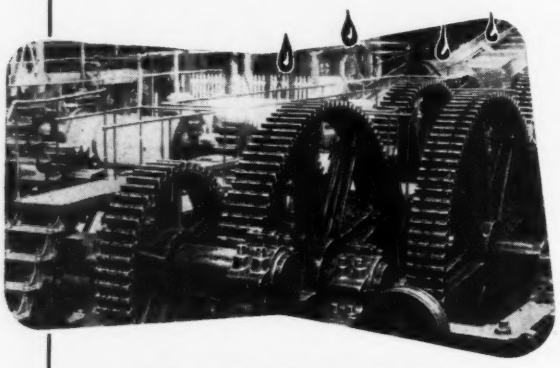

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The following case history is significant:

"A motor-operated hoist equipped with double herringbone cut teeth pinions and gears is used to operate 5-ton clam shell buckets at a large coke plant. Although a high grade plastic compound was applied every 24 hours, it failed to prevent excessive wear of the gearing. On this application, which includes intermittent operation, reversing, high speed, severe shock and contamination from coal dust, Leadolene Klingfast is applied only once every 10 days, and costs 25% less per pound than the lubricant it replaced."

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LUBRICATION CONFERENCE

Case Institute of Technology, Cleveland, Ohio

Three-Day Conference April 3, 4, 5, 1952

Subject: "Lubricants and Their Manufacture"

Fee: $35.00 (For all or part of the Session)

All requests for further information and registration forms should be directed to the attention of Dr. T. J. Walsh, Case Institute of Technology, Cleveland 6, Ohio

ED. NOTE: BELOW IS A CONDENSED SCHEDULE FOR THE COURSE. UNFORTUNATELY, THE SCHEDULE WAS RECEIVED JUST AS WE WERE GOING TO PRESS AND IT WAS IMPOSSIBLE TO PRESENT MORE DETAILED INFORMATION.

SCHEDULE FOR THE 3-DAY CASE INSTITUTE OF TECHNOLOGY LUBRICATION CONFERENCE

Thursday, April 3—

Registration
"Fundamental Aspects of Friction and Boundary Lubrication"
"Hydraulic Film Lubrication"
"Testing and Properties of Lubricants"

Friday, April 4—

"Manufacture of Petroleum Lubricants"
"Additives"
"Blending and Compounding"

Saturday, April 5—

"Greases"
"Ucon Oils"
"Silicone Oils"
"Solid Lubricants"

NOTE: LECTURERS ARE MEMBERS OF THE STAFF OF CASE INSTITUTE AND ASLE MEMBERS WHO ARE NOTED AUTHORITIES IN THEIR RESPECTIVE FIELDS.

Patent Abstracts

(*Continued from page 34*)

Extreme Pressure Lubricating Compositions — Patent #2,580,005 — Elmer B. Cyphers and George M. McNulty, assignors to Standard Oil Development Co.

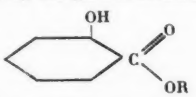
A composition consisting essentially of a mineral base lubricating oil containing about 1 to 20% by weight, based on the total composition, of an extreme pressure additive, said additive consisting essentially of a sulfurized fatty oil treated with about 0.5 to 2%, based on the weight of said sulfurized oil, of a phosphorus sulfide at a temperature ranging between 170 F. to 210 F. for a period of about 15 minutes to one hour during which the phosphorus sulfide is substantially dispersed in said sulfurized fatty oil but substantially unreacted therewith, said composition including also about 0.1 to 2% of a metal deactivator.

Rust Inhibiting Composition — Patent #2,580,036—Alfred H. Matuszak and James W. Hand, Jr., assignors to Standard Oil Development Co.

A mineral lubricating oil containing dissolved therein 0.01% to 10% of pentaerythritol mono-oleate and 0.001% to 5% of propylene diamine.

Mineral Oil Containing Resinified Esters of Salicylic Acid — Patent #2,580,038 — Louis A. Mikeska, assignor to Standard Oil Development Co.

A lubricating oil composition consisting essentially of a major proportion of a mineral lubricating oil base stock having combined therein a minor proportion of a product formed by subjecting the compound having the general formula:



wherein R is a primary straight chained aliphatic hydrocarbon radical containing from 8 to 24 carbon atoms, to a temperature within a range of from about 50 C. to about 250 C. for a period of time within a range of from about 2 to about 20 hours in the presence of an equimolar proportion of formaldehyde.

Mineral Oil Containing Copolymers of Alpha-Beta Unsaturated Dicarboxy Esters with Alpha-Beta Unsaturated Monocarboxy Acids—Patent #2,580,053—Thomas S. Tutwiler, John C. Munday, and Dilworth T. Rogers, assignors to Standard Oil Development Co.

A lubricating oil composition consisting essentially of a lubricating oil base stock and containing from 0.01 to 15% by weight of a copolymer formed by copolymerizing an alpha-beta unsaturated monocarboxy ester having the general formula:

$$CH_2=\underset{\displaystyle Y}{\underset{|}{C}}-COOR$$

wherein R is an alkyl group, and Y is selected from the class consisting of hydrogen and methyl groups with an alpha-beta unsaturated dicarboxy ester having the general formula:

$$R'OOC-\underset{\displaystyle Y'}{\underset{|}{C}}=CH-(CH_2)_n-COOR''$$

wherein R′ and R″ are alkyl groups having an average of not more than 8 carbon atoms, Y′ is selected from the class consisting of hydrogen and methyl groups, and $_n$ is an integer from 0 to 1, the average number of carbon atoms of R′ and R″ subtracted from the number of carbon atoms of R being a number between 5 and 20, the esters being copolymerized in proportions such that the resulting copolymer has an average side chain greater than about C_4 and less than C_{15}.

Lubricant—Patent #2,580,274—Roland F. Bergstrom and Jacobus M. Plantfeber, assignors to Shell Development Co.

A heavy duty lubricant having the following formula:

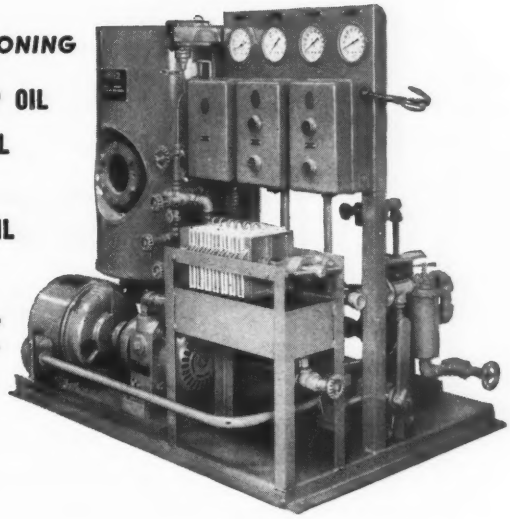
	% Weight
Ca salt of octyl phenol-formaldehyde condensation product	0.05-6
Zn dialkyl dithiocarbamate (oil-soluble)	0.1-5
Ca petroleum sulfonate (oil-soluble)	0.05-10
Phenyl alpha-naphthylamine	0.05-10

and the balance consisting essentially of mineral lubricating oil.

● DEHYDRATES
● DEGASIFIES
● STABILIZES
● CLEANS

IDEAL FOR CONDITIONING

● VACUUM PUMP OIL
● HYDRAULIC OIL
● LUBE OIL
● INSULATING OIL



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Membership in the Society is in several grades as defined below. Assignment to grade is made by the Admissions Committee or Board of Directors on the basis of information submitted or supplied by references.

MEMBERS—$12.50

Members shall be: (1) persons not less than twenty-four years in age who are engaged in research and instruction at technical schools, universities and various publicly and privately supported institutions in the field of lubrication: or (2) persons not less than twenty-four years in age who have occupied recognized positions as Lubrication Engineers for a period of three or more (not necessarily consecutive) years prior to date of admission, involving the responsibility for or supervision of the development, selection, field use and application of lubricants as differentiated from other activities; or (3) persons not less than twenty-four years in age who are indirectly concerned with the field of lubrication, but possessing other qualifications of experience, knowledge and accomplishment, have manifested a particular interest in the purposes and welfare of the Society, to the extent that their membership would be a valuable contribution to the successful functioning of its activities.

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Associate Members shall be: persons less than twenty-four years in age, and those who do not completely fulfill the membership requirements for Members.

SECTIONAL SUSTAINING MEMBERS—$25.00

Sectional Sustaining Members are such persons or organizations as may be interested in and desire to contribute to the support of the purposes and activities of a local Section of the Society.

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Industrial members are such persons or organizations as may be interested in and desire to contribute to supporting the purposes and activities of the Society. The fees paid by an industrial member in general will not be allowed to exceed $150.00 per year.

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SINCLAIR REFINING COMPANY

600 FIFTH AVENUE NEW YORK 20, N. Y.

(*Continued from page* 41)

***Scientific Lubrication*, Vol. 3, No. 10, October, 1951**

SILICONES: A CONSIDERATION OF SOME FACTORS RELATIVE TO THEIR USE AS LUBRICANTS, PART I

Gadsby, G.—pp. 15-19, 32

It was Kipping who coined the name "silicone" (a condensation of "silicon ketone") being under the impression that certain of the compounds which he had isolated were analogues of organic ketones and, although this was later appreciated as being a misnomer, it has been retained and its application extended to envelop all organo-silicon polymers. His review of this work in 1937 terminated on a somewhat pessimistic note for he foresaw negligible prospect of any appreciable advance in this field of chemistry—a point of view which the many subsequent research papers have shown to be unjustified. The main stages in the synthesis of silicones from the basic raw materials are represented in the flow diagram given, Fig. 2. Essential stages are: stepwise replacement of chlorine in silicon tetrachloride by organic radicals, hydrolysis of products, by water treatment, the resulting silanols reacted with each other spontaneously to form larger polymer molecules.

Society of Automotive Engineers, National Diesel Engine Meeting, Chicago, Ill., October 29-30, 1951

OPERATING CONDITIONS OF RAILROAD DIESEL ENGINES

Bloss, E. K.—6 pp.

WHAT IS EXPECTED OF DIESEL ENGINE BUILDERS IN THE FORESEEABLE FUTURE

Everist, H. H. and Hicks, H. N.—10 pp.

Future needs in highway transport field include the following: further reductions in weight, quietness and smoothness, lower initial cost, lower maintenance cost, easier cold weather starting, eliminate external lube oil lines, automatic shut-off upon failure of lube oil supply, total efficiency.

Society of Automotive Engineers, National Fuels & Lubricants Meeting, Chicago, Illinois, October 30-November 1, 1951

OIL FILTERS AND ADDITIVE MOTOR OILS

Georgi, C. W., O'Connell, J. F. and Eitel, T. C. —7 p. and 10 figures

Oil filters containing activated clays as the filter media may readily remove most of the additives from compounded motor oils. Conventional filters utilizing various kinds of cotton, cellulose or paper filtering media are indicated to have no significant additive removing action by direct adsorption. Where soot is the chief contaminant, high detergency type oils will have poor filterability as compared to non-detergent oils. Where lead salts are the major contaminant, the difference in filterability between detergent and non-detergent oils is not so noticeable.

Book Reviews

Petroleum Dictionary and Handbook

Petroleum Educational Institute, 9020 Melrose Ave., Los Angeles 46, Calif.

Specially prepared for buyers, sellers, consumers and salesmen of petroleum products who do not possess a technical background. Over 6,000 non-technical entries and 1000 illustrations. Contained are simple, understandable definitions of many technical and semi-technical terms generally found in periodicals, books and other literature in connection with the application and use of petroleum products and much of the equipment utilizing these products. Also the terms used in connection with the tests and specifications of these same products.

This review is a pre-publication announcement. The first edition will be limited to pre-publication orders. Shipment will be made approximately March 15, 1952. Price: $7.00 accompanying order.

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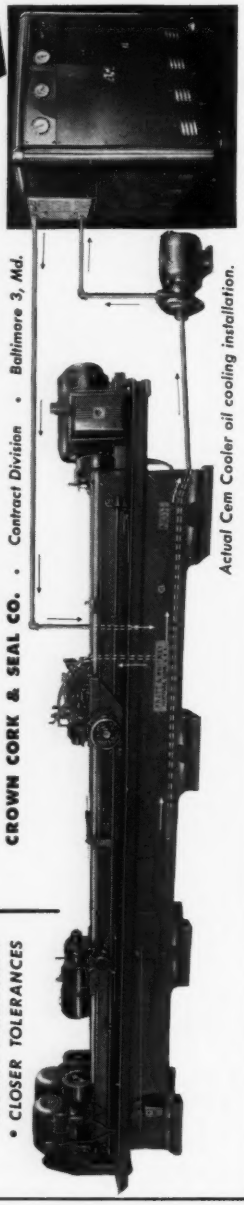

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OUR COVER

"The Ambitious City" — the nickname by which Hamilton, Canada, is known to other Canadians is the industrial heart of the Dominion.

Visited first by the French explorer, Rene Robert Cavalier de la Salle, in 1669, Hamilton has steadily progressed from a trading post at the head of Lake Ontario to a city of 230,000 people and 526 industries.

Steel, textiles, electrical goods, agricultural equipment and rubber tires are the five principal products of this thriving city, but the water-front, which spreads over five miles along Burlington Bay, houses factories that produce everything from railway cars to paper clips and life-saver peppermints. The water-front is heavily dotted with terminal oil tanks and the iron ore, coal and oil that pour in and out of the harbor daily make it the third largest port in tonnage in Canada.

Hamilton is on the two major Canadian railway systems, connections through the Toronto, Hamilton & Buffalo Railway with all United States' roads and it is at the hub of the Ontario highway system.

Within a fifty mile radius of this City there is a fifth of the population of the Dominion and a ready-made market for every type of product is at the doorstep of the manufacturer.

Situated as it is at the foot of Hamilton mountain, it well justifies the phrase "A Panorama of Beauty and Industry."

Lubrication In The News

(*Continued from page* 31)

COOL-O-LUBE: The function of this lubricant-coolant development is that of lubricating and dissipating heat in all metal cutting operations. It is said to render excellent results when applied by the Goodyear Puro-luber, which is the only equipment of its type recommended by the manufacturer for handling Cool-O-Lube.

This solution is sold as a concentrate and is basically diluted one part solution to nine parts water, thereby making for economical consumption. Additional information may be had by writing the manufacturer.

Air Conversion Research Corp.
4107 N. Damen Ave., Chicago 18, Ill.

PERSONALS

Prof. Dr. Leo Ubbelohde: We take pleasure in presenting a photograph of this distinguished German scientist and acknowledged expert in the field of lubrication. Dr. Ubbelohde is the inventor of the famous dropping-point thermometer and the suspended level viscosimeter which bear his name. He was elected General Secretary of the International Petroleum Commission in 1907, founded the Deutsche Gesellschaft fur Mineralolforschung in 1932 and was Vice President of the World-Petroleum Congress in London and Paris in 1933 and 1937. He is also one of the very few men elected an Honorary Fellow of the Institute of Petroleum. We extend our congratulations to him on his 75th birthday on January 4, 1952.

Ed. Note: Our appreciation to Mr. Willy Sonntag of Germany, a member of ASLE, for sending on the above interesting item.

Chief Lubrication Engineer: We are happy to announce that Mr. Charles (SEE PAGE 47)

(*Continued from page* 27)

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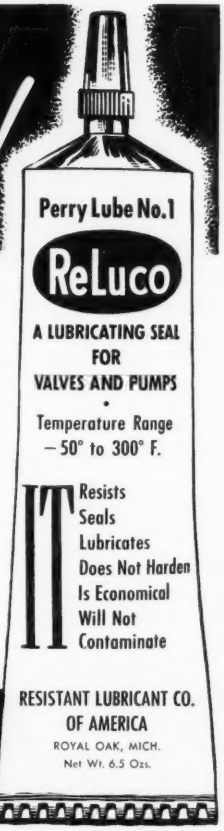
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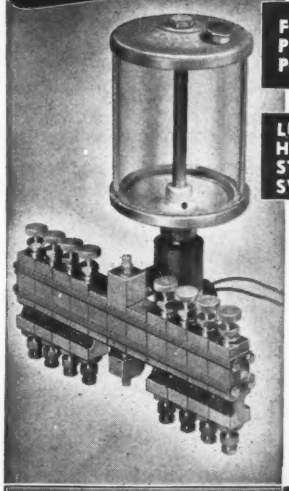

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T. Lewis, a 16-year veteran of Republic Steel Corp., Warren District has been named Chief Lubrication Engineer for the Company, according to W. M. Kelley, Republic's Vice-President in Charge of Operations.

During his 16 years with the Company he served as laboratory analyst, combustion engineer, and since 1945, as lubrication engineer. He is now stationed at Republic's General Offices in Cleveland.

In addition to being a member of several other associations, Mr. Lewis is at present Chairman of the Youngstown Section of the American Society of Lubrication Engineers. We are sure his wide circle of friends and acquaintances will be pleased to learn of Mr. Lewis' new capacity.

News of the Sections

(*Continued from page* 40)

PITTSBURGH

By M. C. Miller, Secretary

"The Part Played by Mechanical Seals in Good Lubrication Practice in Mills and Mines," by C. E. Schmitz, Vice-Pres. and Dir. of Engineering, Crane Packing Co., and President of ASLE.—November 1951 meeting.

(SEE *Lubrication Summarized*)

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ON this Warco press, there are no grease cups. Nothing is left to the judgment of the man with an oil can. The machine is protected by a Farval Centralized System of Lubrication.

Farval makes it routine to see that every bearing regularly gets the exact, measured amount of lubricant it requires. Each work shift, a few strokes of a hand pump lever provide adequate lubrication and keep the press running at top efficiency.

With Farval, special oilers are not needed, lubricant consumption is reduced, bearing life is extended materially and shutdowns for oiling or bearing replacement are eliminated. In short, with Farval on the job, the purchaser of a Warco press is insured of getting all the value built into the machine by its manufacturer.

Farval is the original Dualine system of centralized lubrication for industrial equipment, proved practical in 25 years of service. The Farval valve has only two moving parts — is simple, sure and foolproof, without springs, ball-checks or pinhole ports to cause trouble. Through its full hydraulic operation, the Farval system unfailingly delivers oil or grease to each bearing—as much as you want, exactly measured—as often as desired. Indicators at all bearings show that each valve has functioned.

In or near your city there's a Farval engineer, ready to discuss your lubrication problems and suggest a proper system to meet your particular needs.

The Farval Corporation, 3267 East 80th Street, Cleveland 4, Ohio.

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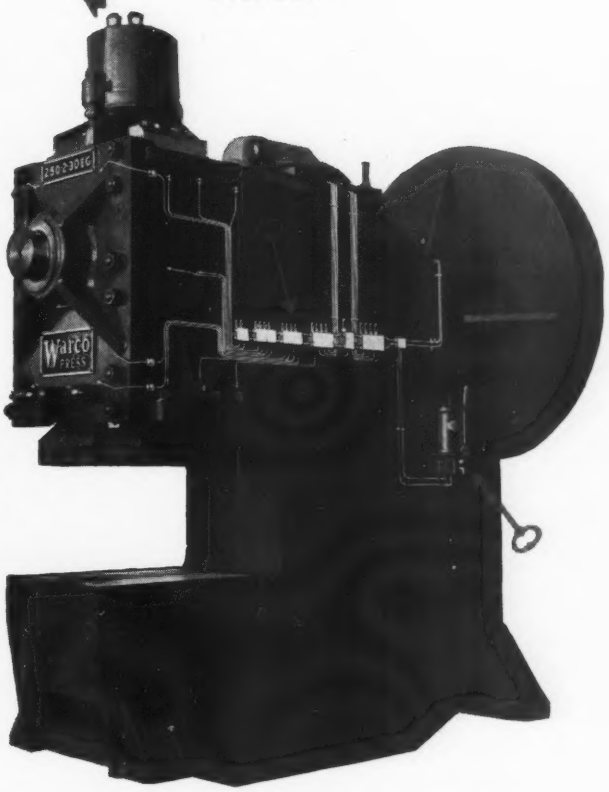

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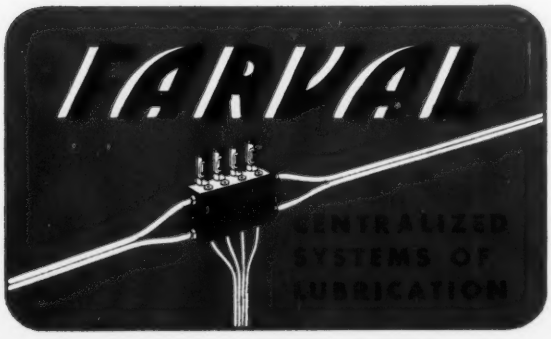
Photo above by courtesy Federal Machine and Welder Co.



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